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ABSTRACT

Testimony and prepared statements presented during three days of hearings in January and February, 1979, concern the problems of asbestos in school buildings. Medical research indicates that the inhalation of asbestos dust vastly increases a person's chances of contacting fatal diseases such as lung cancer, mesothelioma, and asbestosis. Asbestos materials were heavily used in school construction between the years 1946 and 1972. Most of the regulations and safety procedures concerning asbestos apply only to industrial settings. The purpose of the hearings was to establish a program for the inspection of schools for the presence of asbestos materials, to provide funds for the testing and evaluation of potential hazards, and to create a loan program to assist in the containment or removal of imminent hazards to health and safety. Testimony was offered by several nationally recognized experts in the field of asbestos control, particularly in relation to schools. Other witnesses are from federal agencies, and state and local school groups who have been working on the problem. Several companies that have been involved in the manufacture or installation of asbestos materials shared their expertise, as did legal experts who have criticized current regulatory efforts as inadequate. The text for each bill is included. Both H.R. 1435 and H.R. 1524 are cited as the "Asbestos School Hazard Detection and Control Act of 1979." (Author/MLF)

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ED177676

OVERSIGHT HEARINGS ON ASBESTOS HEALTH HAZARDS TO SCHOOLCHILDREN

HEARINGS

BEFORE THE

SUBCOMMITTEE ON ELEMENTARY, SECONDARY, AND VOCATIONAL EDUCATION

OF THE

COMMITTEE ON EDUCATION AND LABOR HOUSE OF REPRESENTATIVES

NINETY-SIXTH CONGRESS

FIRST SESSION

ON

H.R. 1435 and H.R. 1524

TO ESTABLISH A PROGRAM FOR THE INSPECTION OF SCHOOLS FOR THE PRESENCE OF ASBESTOS MATERIALS, TO PROVIDE FUNDS FOR THE TESTING AND EVALUATION OF POTENTIAL HAZARDS, TO CREATE A LOAN PROGRAM TO ASSIST IN THE CONTAINMENT OR REMOVAL OF IMMINENT HAZARDS TO HEALTH AND SAFETY, AND FOR OTHER PURPOSES

HEARINGS HELD IN WASHINGTON, D.C., ON
JANUARY 8, 16; FEBRUARY 22, 1979

Printed for the use of the Committee on Education and Labor

U.S. DEPARTMENT OF HEALTH,
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OVERSIGHT HEARINGS ON ASBESTOS HEALTH HAZARDS TO SCHOOLCHILDREN

MONDAY, JANUARY 8, 1979

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON ELEMENTARY, SECONDARY,
AND VOCATIONAL EDUCATION,
COMMITTEE ON EDUCATION AND LABOR,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9:30 a.m. in Room 2175, Rayburn House Office Building, the Honorable Carl D. Perkins (chairman of the subcommittee) presiding.

Members present: Representatives Perkins, Weiss, Kildee, Miller and Buchanan.

Staff present: Nancy Kober, staff assistant; Toni Painter, secretary; John Martin, minority legislative associate; and Edith Baum, minority labor counsel.

Chairman **PERKINS**. The committee will come to order.

This morning the Subcommittee on Elementary, Secondary, and Vocational Education is conducting a hearing on the possible hazards associated with the presence of asbestos in schools.

Over the past several years, a body of evidence has been uncovered which suggests that asbestos may endanger the health of those exposed to it and may be linked to a rare form of cancer.

But it is only recently that educators, scientists and health specialists have begun to examine whether the health of students who attend schools where asbestos is present is being threatened.

I believe this is a very serious question which warrants the concern of all parents, students and educators. In schools built between 1946 and 1973, the use of asbestos for fireproofing, insulation, acoustics and other purposes was not uncommon.

In some parts of the country, school buildings have been closed for periods of time because of potentially dangerous asbestos situations.

I would like to point out that this problem is not a simple one. There is no consensus on what level of asbestos exposure could be considered dangerous and sampling techniques may not reveal the actual level of infiltration.

In addition, removal or covering over of asbestos can be an extremely expensive process.

On November 13, 1978 I called to the attention of Secretary Califano a situation existing in my congressional district, in Prestonsburg, Kentucky.

I told the Secretary that I thought it is very important that some remedial action be taken without delay, and I would appreciate knowing what is contemplated by the Department on this.

In Prestonsburg, Kentucky, they have had numerous town meetings concerning the asbestos situation. In fact, I had heard that students were out on a strike down there for a period of time.

The removal problem is still up in the air. Many parents are fearful about students being exposed to a cancer-causing substance.

I want to state that Congressman Miller of California, may have a much greater problem in his district than we have in eastern Kentucky. But I have been informed that this situation is very widespread throughout the country.

Mr. Miller has initiated this hearing today and is to be complimented. In fact, I did not intend to commence hearings until after the beginning of the New Congress. But after the new Congress convenes we will hear from the people in Kentucky and other parts of the country.

Possibly Mr. Miller will want to hold hearings in California, Mr. Weiss in New York City. We will have people from Kentucky up here at a later date.

This hearing today will be very constructive, in my judgment.

I personally feel that the Federal Government somewhere along the line will have to be involved because many of the local communities where we have this situation do not have the money to cope with the problem.

That is presently the case in Prestonsburg, Kentucky. I want to find some solution, and the witnesses here today will be able to assist the committee.

In conclusion, I want to compliment my colleague, George Miller, for his leadership in getting the witnesses present here today.

I want to hear from Mr. Miller at this time, and then from Mr. Buchanan.

Go ahead, Mr. Miller.

Mr. **MILLER**. Mr. Chairman, I want to thank you for your remarks and also for the permission to hold this hearing on what I believe to be a very serious problem confronting the educational community in this country.

As you know, another subcommittee of our full committee, the Compensation Health and Safety Subcommittee, has been holding hearings on asbestos-related problems in the industrial workplace as it impacts upon workers and their families.

As a result of those hearings, we have come into contact with people in the community who have been working on the problem of asbestos for some time and have been informed that it appears that there is a rather significant problem relating to asbestos within school sites.

The fact is that although OSHA has established a safe workplace standard for asbestos, it must be emphasized that no recognized threshold of asbestos disease—and even brief exposure may be sufficient to cause cancer many years later.

The most alarming fact is that that industrial standard which we have established for workers does not apply to nonindustrial sites, such as schools.

Yet, we find that out of a survey of over 6,000 schools, it was revealed that asbestos has been used in 1,000 of those schools and that in some schools the asbestos level was 100 times greater than the normal ambient air level.

I think it must be told to this committee that this appears to be particularly serious because children in their growing years may be especially susceptible to cancer.

Medical experts, including those from the Johns-Manville Corporation, have testified that the rapid normal multiplication of cells during childhood, among other factors, may lead to more rapid development of cancer than in adults.

Because they have so long a life expectancy after exposure, children may have a greater likelihood of dying from asbestos-related cancer in later life than a worker exposed in middle age.

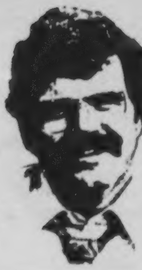
An additional problem is that about eight million teenage children are smoking, making it an even greater risk in contacting asbestos-related cancers.

The problem of asbestos exposure is not limited only to children, however. Teachers and custodial workers are also exposed. I think it must be said that while the problem appears dramatic, both in terms of numbers of schools in which asbestos has been used and which in cases it may be deteriorating and also the fact that we must deal with the problems of removal or sealing, as we will hear witnesses testify today, the cost of doing this in New York City alone has been suggested to be $48 million.

I think we have a problem that is certainly worthy of consideration by this committee in trying to help those local jurisdictions, such as the one you mentioned in Kentucky, where the students have become aware of it, their families have become aware of it, and they are deeply concerned and distressed over the exposure that their children may be susceptible to.

Again, I wish to thank you for the chance to hold these hearings and to receive the testimony that we will hold today.

[Mr. Miller's statement follows:]



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OPENING STATEMENT OF

CONGRESSMAN GEORGE MILLER (CALIFORNIA)

ACTING CHAIRMAN

SUBCOMMITTEE ON ELEMENTARY, SECONDARY AND VOCATIONAL EDUCATION

UNITED STATES HOUSE OF REPRESENTATIVES

"ASBESTOS HEALTH HAZARDS TO SCHOOL CHILDREN"

January 8, 1979

Today's hearing marks the fifth day of testimony before a House subcommittee on the subject of health hazards associated with exposure to asbestos. Because it has been two months since the last hearing, and since this is the first hearing in Washington, I would like to very briefly summarize some of the very important information which was provided in the earlier testimony.

The inhalation of asbestos dust vastly increases a person's chances of contacting fatal illnesses such as lung cancer, mesothelioma, and asbestosis. If the person smokes also, his chances of contracting lung cancer are as much as ninety times greater than someone in the general population. Of these facts, there is no longer any serious debate in the medical or scientific community. Over the past several years, government and industry have established strict rules governing working conditions in which men and women might be exposed to asbestos. During our hearings in Hawaii, several members of this Committee observed rip-out procedures aboard Navy ships at Pearl Harbor. I believe that it is accurate to say that we were impressed with the thoroughness and the caution with which these operations are undertaken.

Unfortunately, however, the demonstration we saw is not representative of current or past practices in American industry. For many years, millions of American workers were exposed to high concentrations of asbestos in a multitude of occupations. About five million workers were exposed to what we now know were dangerous levels of asbestos dust in the shipyards during World War II and thereafter. In many cases, these workers, and as many as six million others, were not protected from inhaling asbestos and were never warned about the potentially fatal effects of exposure to asbestos. We heard testimony from some of them, and from members of their families, to the effect that they had never been told by their employers, including the U.S. Navy, that they were risking cancer or other disabling and fatal illnesses.

We also heard disturbing information that some of the asbestos manufacturers were aware of the health hazards associated with asbestos exposure as long ago as the early 1930s, but did little or nothing to control its use or to inform and protect their employees until many years later. I have received copies of letters from executives of some of these companies, dated 1933 and 1934, which indicate to me a recognition of the severe health hazards associated with asbestos. Moreover, the industrial and medical literature abounds with evidence, as far back as the 1920s, which pointed to the susceptibility of asbestos workers to a wide variety of pulmonary diseases. Some of the asbestos manufacturers even paid compensation to their workers several decades ago for work-related illnesses. As further testiment to the link between asbestos and disability, many insurance companies have long refused to insure asbestos workers.

One of the reasons that it has taken so long for the asbestos problem to achieve prominence is because of the long latency period associated with asbestos. It is typical for asbestos-caused cancers to take up to 30 to 40 years to appear after exposure. This means that we can anticipate large numbers of cases of cancer and asbestosis to begin appearing soon, because we are now within that time frame since the exposures occurred in accelerated numbers. While asbestos is largely a past problem in terms of exposure, therefore, it is a present and future crisis in terms of health effects. Physicians have testified that up to half of the asbestos workers whom they have X-rayed show signs of lung disease. These researchers have said that in future years nearly one-fifth of all cancers will be related to asbestos exposure.

But the problem of asbestos exposure has not been solved. Most of the regulations and safety procedures concerning asbestos apply only to industrial settings. Largely unregulated are commercial exposures, such as the exposure of young children in school buildings. That is the subject of today's hearing.

Asbestos materials were heavily used in school construction between the years 1946 and 1972, when the use of sprayed asbestos for fireproofing and insulation was prohibited by the United States Environmental Protection Agency. In many cases, the sprayed asbestos is friable, and may be discharged into the air if the surface is disturbed through maintenance or other physical activity, including vandalism.

Although OSHA has established a safe workplace standard for asbestos, it must be emphasized that there is no recognized threshhold for asbestos disease. Even brief exposures may be sufficient to cause cancer many years later. The industrial standard, however, does not even apply to non-industrial sites such as schools. One recent survey of 6,000 schools revealed that asbestos had been used in 1,000 of them, and that the presence of asbestos in their air, in some cases, was significantly higher than the permissible industrial standard and the level associated with an increased likelihood of cancer. In some schools, the asbestos level was 100 times greater than the normal ambient air level.

The presence of asbestos in potentially dangerous quantities in school buildings is particularly serious because children in their growing years may be especially susceptible to cancer. Medical experts, including Dr. Paul Kotin of the Johns-Manville Corporation, have testified that the rapid normal multiplication of cells during childhood, among other factors, may lead to a more rapid development of cancer than in adults. Because they have so long a life expectancy after exposure, children may have a greater likelihood of dying from asbestos related cancer in later life than a worker who is exposed in middle age. An additional problem is that about eight million teenage children are smokers, making them even greater risks for contracting asbestos related cancer.

The problem of asbestos exposure in schools is not limited only to children, however. Teachers and custodial workers are also exposed. The American School Board Journal has recently reported the case of a Massachusetts school custodian who died of mesothelioma after having worked for nine years with asbestos. If asbestos materials are to be removed or sealed in school buildings, the workers who perform these jobs are at risk, as are workers who will be involved in the demolition of obsolete buildings in the future.

The cost of repair or removal efforts is a major consideration in the discussion of asbestos in schools. Total removal can cost tens of thousands of dollars per school; the cost for making New York City schools safe has been estimated at as much as $48 million. Currently, the burden for these programs rests with state and local officials. There is some concern that the amounts of the costs may intimidate some local school boards from performing necessary tests on their buildings. Certainly, cost is an important consideration; but it pales in importance compared to the health and safety of millions of school children who may be exposed to life-threatening environments in their classrooms.

There are many complex questions which must be answered before we can arrive at a thoughtful federal policy on this issue.

-- Is there a problem with asbestos in our schools?

-- How severe is the problem?

-- How should we correct it?

-- How much will corrective measures cost? And, who should pay for them-- local schools boards? The states? The federal government? The companies which sold the asbestos or which installed the materials in the first place?

Fortunately, we have a series of witnesses today who can provide us expert answers to many of these questions. We will hear from several of the nationally recognized experts in the field of asbestos control, particularly in relation to schools. We also have witnesses from federal agencies, and state and local school bodies who have been working on this problem. Several companies which have been involved in the manufacture or installation of asbestos materials will share their expertise with us, as will legal experts who have criticized current regulatory efforts as inadequate. I am grateful to all of them for agreeing to participate in this hearing.

Before we begin, I want to raise one cautionary note. Because of the widespread public awareness of the asbestos problem, and especially because we are dealing with children in this hearing, I think it is very important that we all utilize caution in the course of our testimony. If there is a problem, we want to know about it, and what we can do to help solve it as safely and as quickly as possible. We do not want to manufacture a crisis if one does not exist, and we do not want to cause unnecessary public alarm. With that cautionary note, I welcome you all to this hearing, and will proceed with our first witness.

Chairman PERKINS. Mr. Buchanan?

Mr. BUCHANAN. Thank you, Mr. Chairman.

I, too, would like to thank you and commend you, Mr. Chairman, for holding these hearings this promptly. It was my privilege to participate with our colleague from California in hearings on the Compensation Health and Safety Subcommittee on the subject of the problem of asbestos in the working place.

It became quite apparent to me that there is a substantial Federal responsibility in this matter, not only because many of the people who have been exposed to these health dangers and serious health hazards have actually been employed by the Navy, or by the Federal Government, but also because the Federal Government has an obligation to protect the safety and health of America in the working place, and that responsibility was not fulfilled in the case of the dangers of asbestos fibers.

It seems to me, Mr. Chairman, you are also correct that the Federal Government has a responsibility to act if there are dangers to American children and young people in schools from this same substance, and from the health hazards that may be connected with it.

Your fellow Democrat, Thomas Jefferson, is one of my favorite American statesmen, Mr. Chairman. He gave as the motto for the school he founded, the University of Virginia, one that I think is appropriate for the Congress as well: "For here we are not afraid to follow the truth wherever it may lead us."

It is my profound hope the truth will prove that this is not a widespread danger in education in the United States, but to the extent that the truth can be established that there is danger, we must act immediately.

Chairman **Perkins**. I think it may be beneficial for me to read a paragraph from Secretary Califano's response to the letter that I wrote to him on November 13, for the information of the various witnesses today. The Secretary states, in a letter dated January 5, addressed to me:

"The Department has no general authority to assist local school districts in repairing or renovating facilities. Moreover, we believe that the basic responsibility in that area rests appropriately with State and local authorities.

"The Environmental Protection Agency has the regulatory responsibility to deal with toxic substances such as asbestos. I have sent a copy of your letter to Douglas M. Costle, Administrator, EPA, with the request that he advise you of any action EPA is taking with regard to the removal and treatment of asbestos in schools."

I certainly feel that it may be necessary for this committee, at the conclusion of these hearings, to write some remedial legislation that will place direct responsibility upon the Federal Government to help solve this problem.

Mr. Weiss?

Mr. **Weiss**. Thank you very much, Mr. Chairman.

I, too, want to express my appreciation to you for convening these hearings. I am very gratified at the very last comment that you made.

New York, and my district, in particular, serves as one of the more unfortunate examples of the asbestos problem.

In New York City we are talking about millions and millions of dollars. As Mr. Miller indicated, the estimates range close to $50 million.

At a time when city budgets and school budgets across the nation are at their tightest, local officials cannot be solely responsible for locating additional funds.

I think that these hearings are timely, extremely critical, and important for the lives of the children that attend these schools.

Again, my thanks to you for convening the hearings at this time.

Chairman **Perkins**. All right.

The first witness this morning is Dr. Robert Sawyer, Yale University, New Haven' Connecticut.

Dr. **Sawyer**. Mr. Chairman, my entire presentation is based on graphics, slides. At the present time there is no facility for presenting slides. Apparently there is a technical problem.

Chairman Perkins. So you want to postpone your testimony?

Dr. Sawyer. If I could, please.

Chairman Perkins. All right.

At this time we will hear from Dr. William J. Nicholson, Environmental Laboratory Sciences, Mount Sinai School of Medicine, New York. We will hear you at this time.

STATEMENT OF DR. WILLIAM J. NICHOLSON, ENVIRONMENTAL LABORATORY SCIENCES, MOUNT SINAI SCHOOL OF MEDICINE, NEW YORK

Dr. Nicholson. Thank you very much, Mr. Chairman.

Chairman Perkins. I notice the statements are very lengthy today. It would be appreciated if as many of you as possible could summarize your statements and put the complete statement in the record, unless they are so technical it may be necessary to read them.

Go ahead.

Dr. Nicholson. I will be brief, Mr. Chairman.

I appreciate very much the opportunity to appear here. My name is William J. Nicholson. I am an Associate Director of the Environmental Laboratory Sciences, Mount Sinai School of Medicine, which has long been concerned with various aspects of asbestos health effects.

As part of that activity, I have been involved in the direction of various studies measuring the asbestos concentration in the ambient air and in various building circumstances. These have included buildings in which asbestos has been sprayed, as fireproofing material, or for acoustic and sound control.

Included in these studies are about 12 schools, which I would like to review for you.

In the analysis of samples in the background area in various metropolitan cities about the United States in a 24-hour sampling basis, we rarely find air concentrations above 10 nanograms per cubic meter of air. That is ten billionths of a gram per cubic meter of air.

I want to emphasize that because I will be discussing other concentrations measured in buildings as a comparison.

It may sound like a very small amount of asbestos, but if you fragment the fibers that contribute to a nanogram, you can literally have a million fibers, or fibrils, present.

During daytime hours, one finds commonly higher concentrations which can range up to 40 nanograms per cubic meter of air. These higher concentrations can come from brick erosion or construction activities or other sources in the community.

In 1973, we undertook a study of asbestos contaminations of buildings in which asbestos had been used as fireproofing in areas that served as return air plenums, or had been applied for acoustic or sound control as surfaces of walls and ceilings.

In that study, we found evidence that roughly half the samples that we took showed concentrations above that experienced in the background, ambient air taken at the same time.

So, there was clear evidence of asbestos exposure in many buildings where a loose fibril fluffy type of asbestos had been applied either for sound or fire control.

In the fall of 1976 flaking asbestos was reported in a school in Howell Township, which lead Congressman Andrew Maguire to stimulate the National Institute of Environmental Health Sciences to undertake a study, first documenting the extent of asbestos usage in New Jersey schools, the effects of possible contamination from that usage, and the feasibility of remedial action.

I would like to briefly describe the results of a study that we undertook as a contract from NIEHS as a result of Congressman Maguire's initiatives.

The research showed that approximately 265 of 2,400 schools in New Jersey had asbestos materials on hallways, classrooms, auditoriums, or other student use areas. Additionally, there would have been asbestos applied to pipes and boilers.

Many schools also had asbestos applied to their ceilings and walls and other areas of boiler rooms where students would have little access, but from which contamination additionally could occur into the schools.

I would like to focus simply on those areas where it was in student use areas of the school.

We visited 48 of the 265 schools and analyzed the samples of the material. Most had asbestos contents between 10 and 50 percent. Of the 48 schools, 33 had visible evidence of damage, either water leakage, deterioration of the asbestos, or physical abuse by students.

Some of it was minor, but some of it was very serious, with entire hallways having asbestos dislodged from the ceiling by students, or in some buildings literally clouds of asbestos were coming loose from the substrate to which it had been applied.

We did air sampling in those schools and found concentrations up to 2,000 nanograms per cubic meter of air. This would be approximately 100 times that which one commonly experiences in the background ambient air.

In one school actually when we were taking a background sample we found that the school itself was serving as a source into the community producing excess levels outside the school as well as significant levels within the school to which pupils would be exposed.

Additionally, we took measurements during activities where damage was being done to the ceiling similar to that which was there. These were in two schools that removal or sealing operations were about to begin, and those students were present.

Those air concentrations during the period of damage exceeded the time weighted average of the current asbestos standards. So that while the period of the damage may be short, the concentrations are excessive, and they would persist for long periods thereafter.

The conclusions from this analysis work were that if visible damage or erosion of any asbestos contained spray material is evident, increased asbestos air concentrations would have existed at that time and may still persist.

Such damage is likely to continue and air concentrations extending to 100 times background might be observed over long periods of time. Much greater ones would occur over the short period of time that the damage was taking place.

Where visible damage or erosion was not evident, the air concentrations that we measured were no different from background. But the possibility of later damage in future asbestos fiber release with concomitant increased air concentrations cannot be excluded.

Extensive documentation exists of serious disease among workers directly using asbestos or asbestos materials and those working nearby. Additionally, evidence of disease among household contacts of asbestos workers or in those that live about factories has been documented.

Unfortunately, we do not know air concentrations 30 or 40 years ago to which people with such disease were exposed and thus we cannot provide information on a dose response relationship for asbestos disease.

On the other hand, this absence of information also precludes our knowing the existence of a threshold for asbestos disease. At the same time, we know of no concentration below which one can state with certainty that no disease risk exists.

Thus, the prudent person approach would indicate that at the least where feasible excess asbestos exposures be controlled. At the moment we do not know how little asbestos is needed to increase the risk of cancer.

The only exposure that one can state is safe is zero additional exposure. In schools, such control measures are available.

In this project we identified two feasible methods—sealing the asbestos with a surface coating or removing it completely. A third procedure, that of enclosing the asbestos with other building products, also has merit and in particular circumstances could be utilized.

In general, the sealing of a cementitious matrix which is well adhering to a substrate can be appropriate. If there is little likelihood that it would at a later time break loose from that substrate, one can provide a barrier to erosion of asbestos fibers by such procedures.

On the other hand, if the material is loosely attached, friable, already breaking loose, or with significant damage it should be removed. This has been the case in certain schools and has been found to be capable of being done with minimum contamination of the building and following clean-up no residual asbestos would be present in the building air.

The circumstance of use in schools, where you have hallways, auditoriums, or classrooms with large flat surfaces, lends itself well to efficient removal techniques.

However, in each particular school one must look at the situation there to assess what would be the most viable method of control, whether it be removal, covering, or enclosure by other materials.

Each school, in essence, is unique in its own right.

Chairman **Perkins**. Dr. Nicholson, if I have read right—I am a little ahead of you—I think you have very well covered your prepared statement. But as a specialist in Environmental Labora-

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tory Sciences, is there any doubt in your mind that this asbestos must be removed?

Dr. **Nicholson**. I think the requirement is that we prevent and assure there be no exposures to students. In some circumstances removal may be very difficult and not necessary.

That is, if you have in essence a rock hard cement like matrix enclosing the asbestos which is not easily damaged, if one can either by some barrier or other assure that that cannot be damaged and later release asbestos, that may be the more feasible route to take.

Chairman **Perkins**. Let me ask you this question, since you state it is extremely difficult in so far as removal is concerned.

To avoid exposure to the students, should it be done when the school is not in session, or could it be done while the school is in session, or should it be done at the earliest possible date?

Dr. **Nicholson**. In virtually most circumstances it should be done when the students are not in that building. In some of the schools the condition of the asbestos is sufficiently good that one could do this work over the summertime, that it is not a situation where you must undertake control immediately.

In other schools that is the situation. They have been so badly damaged that the exposures ongoing should not be allowed to continue. Again, it really would depend upon the schools.

Chairman **Perkins**. It would depend on the schools. Is there variance in the degree of harm that may result from the type of asbestos that has been used for insulation purposes or for any other purpose?

Dr. **Nicholson**. I think one should not distinguish between the types of asbestos. The data on health effects would indicate that all can readily produce cancer, and that one should consider the risk there, irrespective of the mineral variety.

Chairman **Perkins**. Could you take a sample, for instance, from Prestonsburg, Kentucky of the asbestos used there for insulation in the high school and give us your idea, about the degree of harm that this may bring about and whether it should be removed immediately or wait until the school term ceases?

Dr. **Nicholson**. Could I do that?

Chairman **Perkins**. Yes.

Dr. **Nicholson**. I don't believe so. But many schools have written, and there could have been a response in terms of analysis of asbestos. But I don't think it would have been a response from anyone at our laboratory that would state what the control measures should be for that particular school without seeing it.

Chairman **Perkins**. I see. How do you suggest that the removal take place?

Dr. **Nicholson**. It should be undertaken with complete control so that asbestos not be disseminated in other parts of the building. This involves double enclosure with plastic sheeting, in the walls, floors, decontamination areas for the workers.

Additionally, the workers must be protected so that they do not undergo excess asbestos exposures. Most important, the material should be removed thoroughly wetted.

If you can do this in such conditions, and they are described in the report I have submitted for the record, air concentrations below

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even the current two fiber per mileleter asbestos standard can be maintained in a room undergoing asbestos removal.

Chairman **Perkins**. Let me state that we are going to hold hearings next week. The situation down home has caused so much confusion. We have the General Assembly of Kentucky in session now. We may ask the Governor to add it to the agenda down there.

I want to congratulate you on your testimony this morning.

Mr. Miller?

Mr. **Miller**. Thank you, Mr. Chairman.

Dr. Nicholson, in your study and in your testimony you referred to the prudent person approach which, if I recall law school, is a suggestion of what you ought to do when you know the facts taken to safeguard a hazardous situation.

Then you go on to say that, "We do not know how little asbestos is needed to increase the risk of cancer."

Dr. **Nicholson**. That statement emphasizes the earlier one, that we have no information of a threshold for asbestos cancer.

Mr. **Miller**. We have received testimony in our other subcommittee, however—and I believe that you referred to it in the preliminary information in your study—that we have seen hazards and people contact asbestos-related diseases as a result of living in the household with asbestos workers, be they in manufacturing or insulation, because of the relatively small amounts that they bring home with them on their clothing.

We have seen children and spouses contact these related diseases. So, are you suggesting that the level that should be acceptable in a school would be even less than what we have found in some households?

Dr. **Nicholson**. That is clear. The level that is acceptable in schools is no more than that above background. I mean, we can't unfortunately do anything with background.

Otherwise, I would say the most acceptable level would be zero. But that is not feasible, unfortunately. It certainly would have to be well below those of the past household exposures.

For comparative purposes, I might just mention the data we have of exposures in households which commonly range in the same order, the same concentrations we are measuring in schools, from 100 to 5,000 nanograms per cubic meter of air.

These, however, were in households measured recently. Whether disease will result from such exposures would not be known for decades.

Mr. **Miller**. Well——

Dr. **Nicholson**. I am sorry. Maybe I am not answering the question you really asked.

Mr. **Miller**. I think so. My concern would be if you say that that level of asbestos which should be tolerated in a school is no greater than background, and you have done background samples in the City of New York, you have done background samples in New Jersey, too, is that also correct?

Dr. **Nicholson**. That is correct.

Mr. **Miller**. And then in your study you also point out in some schools you have as much as 162,000 square feet of flaking area. In other schools you have 133,000—excuse me—visible flaking, you have 19,000, 23,000, 35,000 square feet of visible flaking asbestos material.

Then if you go further through the study, in your statement—I want to make sure this is understood—you talked about boiler rooms. Also you have listed here time and again classrooms, hallways, auditoriums, swimming pools, gymnasiums, places of general exposure to the school population.

Dr. **NICHOLSON**. That is correct.

Mr. **MILLER**. And so it is not a question of closing the boiler room door.

Dr. **NICHOLSON**. That is absolutely right.

Mr. **MILLER**. Or the air ducts concealed within walls. We are talking also about places where children, young adults, generally populate in the schools. Is that correct?

Dr. **NICHOLSON**. That is correct. In New Jersey there were three million square feet of asbestos in areas of student use.

Mr. **MILLER**. Of visible flaking?

Dr. **NICHOLSON**. No.

Mr. **MILLER**. Or in use?

Dr. **NICHOLSON**. Of asbestos in use. Some of it was visibly flaking and deteriorating. Most of it was not visibly flaking and deteriorating. In that report, under the column 'Visibly Flaking,' that was the total area of that school some of the asbestos would have damaged, but not all.

There is also a table there that kind of gives the degree of damage in order—zero, one, two, three—with three being the most serious. That would be a case where it was widespread, and virtually all the asbestos in a school or in a classroom with the three category would be damaged.

Mr. **MILLER**. So we have a situation where, as I understand it, the medical community is not prepared to accept a threshold concept in terms of exposure. The idea that you have to be exposed for ten years or five years, heavy concentrations, low concentrations, industrial evidence tends to show that is not so.

We see this dramatic increase in asbestos-related diseases, both cancer and asbestosis. You have a situation where the medical community also suggests that children may be more susceptible because of the multiplication of cells and the growing patterns of those children.

You combine that with the situation in which clearly in your measurements, at least in the New Jersey schools, the levels are much higher than background which you suggest is at least a minimum.

We are not even concerning ourselves with the general environmental exposure to asbestos in these hearings. There is not enough money in the Federal Government to even talk about that problem.

But here we are talking about people who are confined in these various buildings.

I think, Mr. Chairman, you hit on it when you suggest that the magnitude of the problem and the risks we are running really cries out I think for some kind of Federal help, whether it is removal or technical assistance or actual dollars.

I think that we are going to have to come to grips with it because from what we have heard in the industrial side, we have a period of incubation of roughly 25 to 30 years, and we see again this dramatic jump all of a sudden in these reported diseases.

We like to believe that we have taken such steps—and I am not confident that they have really been taken in the industrial side—to mitigate against this exposure to workers.

Now we find we may be incubating a whole new generation or several generations full of new cases to come upon us in the next 25 to 30 years. Is that a fair conclusion of the exposure of these children?

Dr. NICHOLSON. I think that is a fair statement.

Mr. MILLER. Well, I always go back to the example, $300 million for six cases of swine flu. I suggest we may have a much greater epidemic on our hands here in terms of potential danger to the American population than those six cases of swine flu that took 20 minutes to appropriate the money for.

Thank you, Mr. Chairman.

Chairman PERKINS. Mr. Weiss?

Mr. WEISS. Thank you, Mr. Chairman.

Dr. Nicholson, let me express my compliments to you and the Mount Sinai Environmental Laboratory Sciences.

I was chairman of the New York City Council's Committee on Environmental Protection when Dr. Selikoff was instrumental in affecting the ban in 1972 of the sprayed application of asbestos in the City of New York.

The EPA adopted the same position the following year, in 1973.

Have you conducted studies of not only the New Jersey or New York City system, but school systems throughout the country? Are you able to identify on that basis how widespread the problem may be?

Dr. NICHOLSON. I have only limited experience there. In New York City the problem already has been alluded to. There are undoubtedly more than 200 schools, I believe, of 1,100 schools in New York City, with asbestos in student areas.

In Massachusetts it is also widely spread. We have done air sampling in one building there that shows the same problem to be in existence. In New York State additionally I am aware that the same usage of asbestos, the same pattern is present as in New Jersey.

In California it has similarly been reported to me that it is the case there. So that at least in many major States, I think New Jersey is not unique. What we have is somewhere between 10 or 20 percent of schools with this material in place posing a potential risk to what would be more than a million schoolchildren.

The comments of Congressman Miller about their particular susceptibility are quite appropriate. Thus, the problem certainly cries out for urgent action. School districts are waiting, uncertain as to what to do without direction and guidance from appropriate State and Federal agencies.

Mr. WEISS. It is your judgment that this is not the kind of health hazard that can be allowed to be remedied at our leisure, that it does in fact require urgent and immediate action?

Dr. **Nicholson**. In some of the schools there is certainly the need for urgent action. I think there is need for urgent action on the generic problem as well.

Mr. **Weiss**. Thank you very much.

Thank you, Mr. Chairman.

Chairman **Perkins**. Thank you very much, Dr. Nicholson. You have been very helpful to us.

Mr. Miller?

Mr. **Miller**. Dr. Nicholson, if I could just ask you one more question.

It has been suggested in some press accounts that while—and you referred to the Howell case in New Jersey—that there is a great deal of overreaction in that case because the student was thought to be ill as related to asbestos, which was later found out to have mononucleosis or something, and we are really overreacting to a situation here that cannot be justified, that that case was found not to be as serious as first thought, and that all the attention that was brought into New Jersey on that basis—therefore, there is not really a serious problem.

I would appreciate if you would comment on that.

Dr. **Nicholson**. Let me first comment upon the health effects. As you indicated, the health effects as manifest were incorrectly attributed to asbestos.

In all of the school situations that I am aware of, I think it would be very unlikely that there would ever be such manifestations at this time.

We are not concerned about acute, immediate apparent health effects to children. We are concerned about what, as you indicated, will happen 20, 30, 40 years down the line.

In the Howell Township situation the reaction was generated by this misdiagnosis of disease. The situation in that school, though, was severe. I read reports in the New York Times of children taking the asbestos and throwing it at one another.

That situation required urgent action. The action I think that was taken was precipitous in that inadequate controls were provided during removal, and contamination throughout the building took place.

This again points to the need for direction and guidance such as that when serious situations are identified rapid but proper action can be taken. The Howell Township should have been controlled rapidly, but it should have been controlled correctly.

Mr. **Miller**. Thank you.

Chairman **Perkins**. Thank you very much.

[The complete statement of Dr. Nicholson follows:]

Testimony of William J. Nicholson, Ph. D.

Environmental Sciences Laboratory
Mount Sinai School of Medicine
New York, N. Y.

My name is William J. Nicholson. I am Associate Director of the Environmental Sciences Laboratory of Mount Sinai School of Medicine. The laboratory, which is directed by Dr. Irving J. Selikoff, has long been active in the field of asbestos health effects. Since 1969 my work has involved the direction of projects analyzing asbestos in air, water, and tissue samples. Additionally, I have conducted several epidemiological studies concerned with the health of individuals exposed to asbestos in occupational and environmental circumstances. Completed studies of asbestos in the ambient air or in public buildings in which asbestos materials have been used include:

Asbestos Air Pollution in New York City
New York City Contract
(A study of asbestos concentrations in the ambient air of New York and about buildings in which spray fireproofing materials were being applied)

Measurement of Asbestos in the Ambient Air of U. S. Cities
National Air Pollution Control Administration Contract CPA 70-92
(A study of quarterly composites of 24 hour samples collected in 49 cities of the National Air Surveillance Network)

Asbestos Contamination of the Air in Public Buildings
Environmental Protection Agency Contract 68-02-1346
(A study of air in buildings in which asbestos materials had been applied for sound or fire control)

Chrysotile Asbestos in Air Samples Collected in Puerto Rico
Consumer Products Safety Commission Contract 77128000
(A study of the air of schools and homes in Puerto Rico constructed of asbestos cement products)

Control of Sprayed Asbestos Surfaces in School Buildings: A Feasibility Study
National Institute of Environmental Health Sciences Contract NO1-ES-7-2113
(A study of the extent of use of asbestos in New Jersey schools and of the feasibility of sealing or removing asbestos from student areas)

In the course of the above research more than 500 samples of air collected in over 50 cities and 40 public buildings have been analyzed for asbestos. These include approximately 50 samples collected in 12 schools.

The results of this research has shown that asbestos of the chrysotile variety can be found as a ubiquitous contaminant of the ambient air of all metropolitan areas. Over 24 hour sampling periods, concentrations up to 90 nanograms/meter^3 (ng/m^3) (A nanogram is a billionth of a gram) have been measured in composites of quarterly samples. Of these long term samples, most (about 95%) had concentrations less than 10 ng/m^3. In the analysis of six to eight hour samples collected between 8 AM and 5 PM higher concentrations are commonly found, often up to 40 ng/m^3. These increased levels can be attributed to such sources as erosion of asbestos from automobile brakes or from construction activities.

During the period of 1969-1971 asbestos concentrations up to 400 ng/m^3 were measured at rooftop levels of buildings located up to 1/2 mile from construction sites where asbestos-containing materials were being sprayed for fireproofing purposes. This evidence of widespread contamination led to the prohibition of this use of asbestos by several governmental entities in 1972 (e.g. New York City, Boston Illinois) and nationally by the EPA in February 1973.

In 1973 we undertook a study of the asbestos contamination of buildings in which asbestos materials had been applied for fireproofing or acoustical purposes. That study involved the collection and analysis of 119 samples collected in 20 buildings of five U. S. cities. The results showed evidence of air contamination in buildings in which a loose, fluffy, fibrous -type of asbestos spray material had been applied. either for sound control or to structural steel for fireproofing in spaces used as return air plenums. The report of that study recommended:

> An effective inspection and monitoring program should be developed that would verify the integrity of asbestos spray material used for acoustic or decorative purposes on the walls and ceilings of bublic rooms and buildings.
>
> Periodic spot sampling and analysis of the air in buildings using cementitious fireproofing should be made in order to assure that future air contamination of these buildings does not occur
>
> More extensive sampling and analysis for asbestos should be done in those buildings where fibrous spray fireproofing has been used, in order to define the full extent of asbestos air contamination.

Research must be undertaken to determine an effective and economically feasible air cleaning system that can be used in buildings with air supply plenums sprayed with such fibrous materials

Procedures should be developed for use during maintenance activities that may be required in asbestos-lined plenum spaces in order to minimize possible building air contamination.

Procedures must be developed and specified for use in those buildings in which the asbestos is to be removed because of unacceptable contamination. Here, consideration must be given to both occupational and future environmental exposures.

In recent years attention has been called to the presence of asbestos in pupil use areas of schools, and to the associated potential health hazards. Damage to asbestos coated surfaces was seen, with friable materials found flaking and contaminating large areas, in a grade school in Wyoming, a university dormitory in California and in the Yale School of Arts and Architecture in New Haven. In both the Wyoming school and the Yale Library air measurements by optical microscopy for asbestos showed concentrations that in some circumstances exceeded the then existing occupational standard of 5 fiber/milliliter (f/ml). In the case of the Yale Library detailed documentation has been provided on asbestos exposures before, during and after removal of the insulation material by Dr. Robert Sawyer.

In the fall of 1976, loose flaking sprayed asbestos was seen in a school of Howell Township, New Jersey, leading to its removal and to further concern about the presence of deteriorating asbestos in other school buildings in New Jersey. Through the auspices of Congressman Andrew Maguire of New Jersey the National Institute of Environmental Health Sciences undertook to determine the extent of the asbestos problem in New Jersey schools and to demonstrate the feasibility of possible control measures. Under a contract from NIEHS the Environmental Sciences Laboratory of Mount Sinai undertook this study. A copy of the final report is included for your record.

The research revealed that of approximately 2400 schools in New Jersey, 265 in 142 districts had nearly three million square feet of asbestos material in classrooms, auditoriums, hallways and other rooms accessible to pupils. Forty-eight of these schools were visited and material samples taken of what was thought to be asbestos-containing surface coatings. The analysis of these samples revealed that most contained between 10% and 50% asbestos. Of the 48 schools, 33 had evidence of damage to the asbestos surfaces, ranging from minor, localized damage, to severe, widespread abuse and deterioration. Extensive physical damage was seen in some schools and in some circumstances loose shrouds of asbestos were hanging from the surfaces or had fallen to the floors. Air sampling in several schools revealed concentrations up to 2000 ng/m^3, higher even than those we had earlier measured about sites of spray fireproofing. Often concentrations in excess of 100 ng/m^3 were found; these were always in association with visible evidence of damage or deterioration. Air samples were taken in two schools during activities which produced damage similar to that already present. (This was done in two schools in which the asbestos material was about to be removed or sealed.) Air concentrations exceeding 2 f/ml were found, i. e. above the current time weighted average asbestos standard for workplaces.

The conclusions that can be drawn from this work include:

If visible damage to or erosion of any asbestos containing sprayed material is evident, increased asbestos air concentrations would have existed at the time of damage and may still persist

Such damage is likely to reoccur or to continue. In such circumstances air concentrations 10 to 100 times normal background may be expected.

Where visible damage or erosion is not evident, asbestos air concentrations are likely to be little different from background, but the possibility of later damage and future asbestos fiber release with concomitant increased air concentrations cannot be excluded.

Extensive documentation exists of serious disease among workers directly using asbestos or asbestos materials and those working nearby. Additionally, asbestos cancers have been identified in people who simply live in the household of an asbestos worker or about an asbestos factory. Unfortunately, we do not have accurate knowledge of the concentrations of asbestos to which individuals were exposed 30 or 40 years ago in the above circumstances. Thus, health effects cannot be unequivocally ascribed to asbestos air concentrations in the range of 100-1000 ng/m^3 as found in the New Jersey schools sampled and in other buildings with similar conditions. Furthermore, it is unlikely that a clear association of such levels and the presence or absence of asbestos disease will be made in the foreseeable future. However, this absence of dose-disease data at lower exposures levels (non-occupational) also precludes our having knowledge of a threshold for asbestos-cancer (as for carcinogens in general). Thus, "the prudent person" approach would indicate that, at the least, where feasible, excess asbestos exposures be controlled. At the moment, we do not know how little asbestos is needed to increase the risk of cancer.

In schools control methods are available. In this project two possible methods were investigated; the complete removal of asbestos-containing materials, and the "sealing" of such material by an appropriate covering agent. A third procedure, that of enclosing the asbestos with other building products also may be appropriate in particular, limited, circumstances.

In general, sealing of firm, intact, cementitious asbestos materials proceeded smoothly with no measureable dissemination of asbestos fibers into adjacent school areas. An attempt to seal loosely-bonded fibrous asbestos material was not successful. In many circumstances, the use of sealants over well adhering cementitious type asbestos mixes may be warranted. They are relatively easy to apply, compared to removal in these circumstances and can prevent or minimize surface erosion of fibers. When loosening of the asbestos from the substrate is no problem, this may be the control measure of choice. This procedure, however, allows the asbestos to remain in place. It may subsequently be dislodged during maintenance and renovation activities, and during demolition of the building, full removal containment procedures would be required. Furthermore, one may not have complete assurance that the asbestos matrix will remain locked to the substrate. Water damage and physical abuse could produce dislodgement in the future.

In many typical circumstances found in New Jersey schools in which loosely compacted, friable asbestos-containing materials are applied to flat, open areas as hallways, classrooms and auditoriums, the removal of asbestos materials can be accomplished efficiently and effectively. Complete wetting of the asbestos, careful enclosure methods and thorough cleanup can minimize contamination from removal operations. Once removed, any concern for future asbestos related problems is eliminated. For many school situations with loosely-bonded asbestos which is flaking from its substrate, it may be the control procedure of choice. However, each school situation is unique. It must be carefully assessed and control procedures selected for the particular circumstance in an individual school.

The use of asbestos in schools of New Jersey is not unique. New York City has determined that asbestos materials are present in student use areas of over 200 of 1100 schools. In Massachusetts extensive use of asbestos in schools has been reported. It is a nationwide problem. School districts have limited resources. They are hesitant to undertake requisite control procedures in the absence of appropriate guidance and assistance. With a potential asbestos exposure to more than a million children urgent action is required by appropriate federal and state agencies.

ASBESTOS CONTAMINATION OF BUILDING AIR SUPPLY SYSTEMS

William J. Nicholson, Arthur N. Rohl, Irving Weisman
Environmental Sciences Laboratory, Department of Community Medicine, Mount Sinai School of Medicine of the City University of New York

Asbestos-Containing Spray Fireproofing

Sprayed, asbestos-containing, inorganic fiber insulation was introduced into the United States in 1935. It found considerable use during the late 1930's and 1940's for decorative finishes and acoustical insulation in night clubs, restaurants, hotels, and other buildings. When this material was also found to be useful as a fireproofing agent, Underwriters Laboratories gave approval for this purpose in 1950. The first use of sprayed asbestos-containing material for strictly fireproofing purposes in a large multiple-storied building occurred in 1958, with the construction of the 60-story Chase Manhattan Bank building in New York City. This use expanded rapidly until, in 1970, well over half of all large multi-story office buildings constructed in this country made use of such sprayed material as a fireproofing agent. Formerly, structural steel in multi-story buildings had to be encased in concrete to prevent buckling in case of fire. The use of sprayed asbestos material provided adequate fire protection and reduced installation costs through its rapid application and a lower weight load upon the structural steel components. Such spray material also has found use for thermal insulation and condensation control.

There are two principal methods of applying sprayed mineral fiber. In the dry method, dry material, including binders, is dumped from a paper shipping bag into a large hopper, where the material is agitated and subsequently blown into a 3- or 4-inch hose. The hose conveys the material to a nozzle at the actual site of application. As the dry material leaves the nozzle, it passes through the focus of a ring of fine water jets. Mixing takes place at this focal point, which is within 18 inches from the end of the nozzle. This produces a fibrous matrix held to the steel by the water-activated binders.

The wet method differs in that the material is premixed with water in the hopper, and the resulting slurry is pumped through a hose and sprayed upon the surface to be coated. The mechanical equipment is similar to that used to apply plaster. Portland cement and gypsum present in the cementitious wet mix provide a bond to building steelwork. Of the two application procedures, the surface produced by the cementitious procedure is significantly less friable.

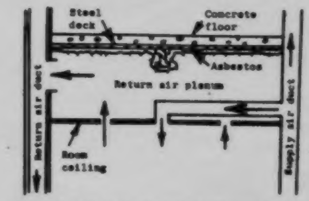
The material used for dry spray fireproofing in building construction usually is a blend of 5 to 30% chrysotile asbestos fiber, mineral wool, clay binders (as bentonite), adhesives, synthetic resins, and other proprietary agents, such as oils. The material used for acoustical and decorative purposes may contain a greater percentage of mineral wool and little or no asbestos fiber. Materials applied as a sprayed slurry often will contain vermiculite, gypsum, and shorter asbestos fibers. Because the cementitious material has a much greater density and increased weight per unit area, a supporting structure must be designed accordingly.

The quantity of mineral fiber used for spray applications in the United States increased steadily from 1958 to 1970. It has been estimated that 40,000 tons of material were used for fireproofing alone in 1969. (1) In 1969 and 1970, a survey of asbestos emissions in New York City revealed that the major office buildings under constructions in Manhattan would use in excess of 5,000 tons of spray fireproofing material, estimated to contain approximately 700 tons of asbestos. Smaller buildings under construction in other boroughs use perhaps an equal amount of such asbestos material.

During the application of spray fireproofing material, it was not uncommon for the widespread dissemination of asbestos to occur. In an earlier study, (2) measurements made about sites of spray application of asbestos showed environmental asbestos concentrations to exceed those of background by more than 100 times. Because of concern for the possible health effect on the populations of urban centers from such use of asbestos, this procedure was prohibited in various localities (New York, Boston, Philadelphia, Illinois) in the early 1970's, and finally prohibited nation-wide by the Environmental Protection Agency in 1973.

One insidious form of possible environmental asbestos exposure, however, remains from this process, either through damage or erosion of acoustical spray materials, or through erosion into building air supply systems of asbestos fibers from spray-lined plenum spaces in office buildings. Figure 1 schematically illustrates a duct -supply, plenum-return air system commonly used in recently constructed buildings.

Figure 1



Cross-section of ceiling plenum space showing air flow and location of fibrous spray fireproofing covering structural steel

Here, air is supplied to occupied rooms through sheet metal ducts. Return air, however, is not ducted but passes through a plenum space formed by the hung ceiling of a room and the underside of the floor above. It then is carried to the fan room through centrally located ducts, mixed with perhaps 15 to 20% fresh air, undergoes minimal filtration, and then is recirculated throughout the building. An alternative procedure, that of having the return air also carried in a sheet metal duct from building rooms adds significantly to construction costs. As the steelwork within the plenum space has usually been sprayed with asbestos-containing material, the possibility of erosion of asbestos fibers into the air supply system exists. Additionally, maintenance activities within this space can damage the fireproofing and contaminate the air supply system.

Assessment of Asbestos Contamination

To test this possibility, 116 samples of indoor and outdoor air have been analyzed for asbestos. Nineteen buildings in five United States cities were chosen to represent the various construction uses of asbestos-containing spray materials. Usually, eight samples were taken at a given building site: two within the fan chamber sampled the return air most recently in contact with the fibrous spray material, four samples in offices at different locations within the building, and two samples of outside air taken on the roof or at the air intake to the fan room. In

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general, samples were taken over an 8- to 16-hour time period during normal operation of the air distribution system. Occasionally, samples would be taken at night to minimize inconvenience to building occupants. Most buildings were sampled twice, on consecutive days.

The samples were collected on 0.8 μ pore size Millipore filters, having an effective area of 10.8 cm^2. The air flow was produced by a vacuum pump fitted with a 10-l/min critical orifice. Following submission to the Environmental Protection Agency in North Carolina and coding, the 116 samples were analyzed using previously described electron microscopic techniques.

To prepare a sample for such analysis, a portion of the membrane filter with the collected material was mounted on a microscope slide and ashed in a low temperature activated oxygen asher for 30 minutes to one hour. This served to remove the membrane filter material, all organic material in the collected sample, soot, and other carbonaceous material. The residue, consisting mostly of fly ash and mineral matter, was dispersed on the microscope slide by grinding the sample with a watch glass in a solution of 1% nitrocellulose in amyl acetate for 5 to 10 minutes. The sample was dispersed fairly uniformly over two microscope slides by placing another glass microscope slide over the ground sample, and drawing the microscope slides apart. Upon evaporation of the amyl acetate, the dispersal was scanned for uniformity by light microscopy, and representative areas were chosen for transfer to electron microscope grids for scanning. For each sample, at least one grid square from four separate prepared grids was scanned. In some cases, usually those with exceptionally high values, eight grids were scanned from two sample preparations to increase the reliability of the results. In general, the scanning of additional square yielded values approximately those originally obtained, and the results were simply averaged.

The processing of blank filters with each set of four samples served to monitor contamination and provide a measure of laboratory background. These analyses indicated an average background level of 10 nanograms (ng) existed, and this value was subtracted from each sample mass prior to the calculation of the concentration. This, in turn, led to equivalent background of from 2 to 5 ng/m^3 in a given sample of the sets analysed here. As the background is independent of the volume of air sampled, those samples with the larger air volumes had the lower correction value.

Table 1 lists the average asbestos concentrations of indoor and outdoor air in different buildings grouped by the type and use of insulation material. Considerable variability exists in the air concentrations measured in various buildings. Average values found for the air inside buildings range from 2.5 ng/m^3 to 200 ng/m^3, with individual measurements from 0 to 800 ng/m^3. For the outside air, the variation for the average concentration at a given site extends from 0 to 46 ng/m^3. Contamination is suggested in those buildings that have average levels at least three times greater and 10 ng/m^3 higher than concentrations measured outside. Of the four buildings in which contamination is suggested (buildings B,C,D, and F, fireproofed with fibrous spray), two were recently constructed and the other two were unique in that no sealant had been applied over the asbestos spray material.

While no widespread evidence of contamination was found in this study of buildings having decorative or acoustic spray, three buildings with decorative spray had a sample with a fiber concentration exceeding 100 ng/m^3, suggesting localized contamination. Additionally, incidents of contamination of such buildings have occurred elsewhere. Where it occurred, visible damage to spray material was evident.

Table 1

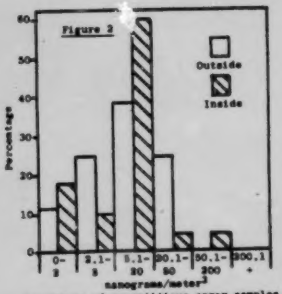
Average Asbestos Concentrations in the Air of Buildings According to Type of Spray

Building	Average Asbestos Concentration (ng/m^3) Building Air	Average Asbestos Concentration (ng/m^3) Outside Air	Year Building Constructed
Cementitious Spray			
A	68*	46	
B	12	18	1966
C	7	5	1970
D	2.5	8	1972
E	12	9.2	1968
F	9.5	24	1968
Fibrous Spray			
A	8.7	3.9	1966
B (no sealant)	30	9.2	1969
C (no sealant)	77	12	1970
D	28	8	1972
E	11	14	1968
F	200	--	1972
Acoustic or Decorative Spray			
A	3.1	4.3	1968
B	8.3	18	
C	41*	33	
D	17*	--	
E	27*	--	
No Asbestos Spray			
A	7.5	0	1903
B	9.3	2.0	1973

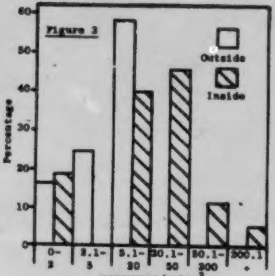
*An individual value exceeding 100 ng/m^3 was found, suggesting localized contamination.

Distributions of individual asbestos concentrations for buildings using cementitious and fibrous spray are plotted in Figures 2 and 3. A similar plot for buildings with acoustic or decorative spray was not possible as only limited data were available on outside air concentrations at the time of sampling.

Figure 2



Percentage of cementitious spray samples lying within a specified concentration range



Percentage of fibrous spray samples lying within a specified concentration range

Referring to the figures, it can be seen that a greater percentage of concentrations exceeding 20 ng/m^3 is found in building air of those buildings in which dry-type asbestos spray fireproofing has been used. (Twenty ng/m^3 is arbitrarily selected for this comparison, as most measured ambient air asbestos concentrations, in the absence of specific sources, are lower.) (3) Here, over half of the indoor samples exceeded 20 ng/m^3 with none of the outside concentrations in excess of this value. On the other hand, there was no significant difference in the distribution of air concentrations in buildings using cementitious fireproofing material.

Environmental Asbestos Concentrations

For comparison purposes, Table 2 lists the range of chrysotile concentrations in quarterly composites of 24-hour ambient air samples taken in 50 metropolitan areas. (2) As can be seen, the great majority of these samples lie in the concentration range under 10 ng/m^3. Only two exceed 20 ng/m^3, and only one exceeds 50 ng/m^3 - a sample taken in a city having four asbestos brake lining manufacturing plants with uncontrolled emissions.

Table 2

Chrysotile Content of Ambient Air Samples Collected by NAPCA

Number range in 10^{-9} g/m^3	No. of Samples in range
0.1- 0.9	61
1.0- 4.9	103
5.0- 9.9	13
10.0-19	9
20 -49	2
50 +	1
Total samples	187

Table 3 lists chrysotile air levels near sites of spray fireproofing taken during the time period 1969-1970. Here, levels much in excess of background concentrations can be seen. In other determinations of non-occupational asbestos concentrations, data taken in homes of asbestos workmen suggest air levels often are in excess of 100 ng/m^3. The highest concentration measured in such circumstances has been 5,000 ng/m^3.

Table 3

Chrysotile Levels Near Spray Fireproofing Sites

Sampling location	Number of samples	Asbestos air level in 10^{-9} g/m^3	
		Range	Average
1/8-1/4 mile	11	9 -375	60
1/4-1/2 mile	6	8 - 34	25
1/2- 1 mile	5	3.3- 36	18

Health Effects

Data are accumulating that exposure to asbestos in other than occupational circumstances is sufficient to produce disease. In 1960 Wagner (4) documented cases of mesothelioma in residents of an asbestos mining area of South Africa. Many of these individuals had never worked with asbestos; their exposure was associated with living about the mines, mills, or roadways along which the asbestos fiber was transported. In 1964, in a review of 76 cases of mesothelioma in the London Hospital by Newhouse and Thompson, (5) roughly half were found to be in the former employees of an asbestos products manufacturing facility. The disconcerting feature was that of the remainder, 11 were in individuals who lived within one-half mile of the asbestos factory, and nine were in individuals who lived with workmen employed in that factory. Recently, a study (6) of the population of relatives of former workmen of an amosite products factory in Paterson, New Jersey, has shown that 38% of family members have X-ray evidence characteristic of asbestos exposure. Additionally, four cases of mesothelioma have so far been identified in this group of relatives of asbestos workmen.

No exposure data exist on the concentrations of asbestos dust to which these various populations were exposed 20, 30, or 40 years ago. However, the finding that most peak environmental asbestos exposures in similar circumstances (about sites of spray asbestos application, about uncontrolled asbestos factory operations, and in homes of insulators or asbestos factory workmen) are usually in the hundreds of ng/m^3, with occasional values exceeding 1,000 ng/m^3, suggests that long-term exposure of many people to concentrations above 100 ng/m^3 creates a risk of later asbestos disease. Thus, the higher levels observed in some buildings in this study should be viewed with concern.

Future Monitoring Perspectives

A. Cementitious spray fireproofing

No evidence was developed in this study for asbestos erosion from cementitious spray fireproofing material used in the plenums of building supply systems. This conclusion, however, is a tentative one, as it is drawn from a limited sampling program in only six buildings. Prudence would suggest that periodic sampling of such buildings be initiated in order to verify the continued validity of the results presented here.

B. Decorative or acoustic spray application

Indications of contamination of public buildings from past application of acoustic spray exist in this study, as well as many isolated circumstances. Noteworthy in the latter category are a school in Wyoming, a Yale library, the Long Beach courthouse, and a U.C.L.A. dormitory. In all circumstances where significant air contamination has arisen, however, directly visible damage to the sprayed material was evident. Thus, visual monitoring of the structural integrity of the spray material appears to be sufficient to assess possible contamination. Where damage is found, however, corrective action should be taken. This action may extend from appropriately resealing the material, to complete removal, as has been done in the specific cases mentioned above.

C. Fibrous, asbestos-containing, spray fireproofing

This study presents strong evidence for the erosion of fibers in some buildings fireproofed with fibrous-type, dry-spray, asbestos-containing material. This is particularly evident in those buildings most recently constructed and in those buildings in which no sealant was applied over the spray material. Moreover, all buildings will at times have repair and maintenance activities taking place in the plenum space that can lead to contamination incidents. Since visual monitoring of the integrity of the spray material in the plenum space is not possible, investigations should be made of feasible filtration systems that can be used in these buildings to remove any asbestos contamination that may occur from erosion of the fireproofing material.

D. Recommendations for future monitoring

1. An effective inspection and monitoring program should be developed that would verify the integrity of asbestos spray material used for acoustic or decorative purposes on the walls and ceilings of public rooms and buildings. This would be primarily a visual inspection to verify that damage to such material was not taking place. Only in isolated circumstances would air sampling be necessary.

2. Periodic spot sampling and analysis of the air in buildings using cementitious fireproofing should be made in order to verify the results of this study and to assure that future air contamination of these buildings does not occur.

3. More extensive sampling and analysis for asbestos should be done in those buildings where fibrous spray fireproofing has been used, in order to define the full extent of asbestos air contamination.

E. Recommendations for future control procedures

1. Research must be undertaken to determine an effective and economically feasible filtration system that can be used in buildings with air supply plenums sprayed with such fibrous materials.

2. Procedures should be developed for use during maintenance activities that may be required in asbestos-lined plenum spaces in order to minimize possible building air contamination. Consideration should be given to system isolation, area enclosure, localized wetting, and cleanup by vacuuming.

3. Procedures must be developed and specified for use in those buildings in which the asbestos is to be removed because of unacceptable contamination. Here, consideration must be given to both occupational and future environmental exposures.

References

1. Reitze, W.B., Nicholson, W.J., Holaday, D.A. and Selikoff, I.J.: Application of Sprayed Inorganic Fiber Containing Asbestos: Occupational Health Hazards. Am. Ind. Hyg. Assoc. J. 178-191 (1972).

2. Nicholson, W.J. and Rohl, A.N.: Asbestos Air Pollution in New York City - Final Report to City of New York Department of Air Resources (1971). See also: Nicholson, W.J. and Pundsack, F.L.: Asbestos in the Environment. Biological Effects of Asbestos, pp. 126-130, IARC, Lyon (1973).

3. Nicholson, W.J.: Measurement of Asbestos in Ambient Air. Final Report to the Environmental Protection Agency, Contract CPA 70-92 (1971). See also: Nicholson, W.J. and Pundsack, F.L. op. cit.

4. Wagner, J.C., Sleggs, C.A. and Marchand, P.: Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province. Brit. J. Ind. Med. 17:260-271 (1960).

5. Newhouse, M.L. and Thompson, H.: Mesothelioma of Pleura and Peritoneum Following Exposure to Asbestos in the London Area. Brit. J. Ind. Med. 22:261-269 (1965).

6. Anderson, H.A.: Conjugal Asbestos Neoplastic Risk. Ann. N.Y. Acad. Sci. (in press).

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Control of Sprayed Asbestos Surfaces in School Buildings: A Feasibility Study

Report to the
National Institute of Environmental Health Sciences
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1. INTRODUCTION

In the fall of 1976, attention was drawn to loose, flaking asbestos material in a New Jersey School and to concern regarding asbestos materials in other schools in the state. Further, such materials had been identified in schools in New York, Massachusetts, California and other states, where they had been applied on walls, ceilings and other surfaces for insulation or decorative purposes; this pointed to a possible general problem nationwide. Various control measures were proposed or utilized in different circumstances, including complete removal of the asbestos materials, covering them with a sealant, or enclosing them with other building materials.

This project was undertaken to assess the extent of use and current condition of asbestos surface materials in New Jersey schools, to evaluate the potential for asbestos exposures to pupils and to evaluate the feasibility of removing the asbestos materials or sealing them with appropriate coatings.

2. USE OF SPRAYED ASBESTOS MATERIAL

Sprayed fiber insulation material containing asbestos was first introduced in 1932 in Great Britain, where it was used for condensation control and noise abatement.[1] Because of the excellent heat resistant properties of the material, it was also quickly adapted for thermal insulation purposes. The first use of sprayed asbestos in the United States was in 1935, when the material was found suitable for acoustic purposes and for decorative finishes in public spaces in nightclubs, restaurants, hotels and other buildings.

The use of sprayed-asbestos materials in the United States expanded rapidly after World War II, with an important additional use being the fireproofing of structural steel and other components of high rise office buildings in major cities. This began in 1958 and continued through the 1960's. At the same time, continued use was made of sprayed asbestos materials for thermal insulation and decorative or acoustical purposes. Noise control was a major reason for sprayed asbestos materials being applied in auditoriums, libraries, hallways, classrooms, and other areas of school buildings. As these uses of asbestos expanded, so did the variety of spray materials. Subsequent to World War II asbestos was contained in loosely-bonded, fibrous mixes, cementitious formulations, plaster materials and textured paints.

During the latter part of the 1960's concern arose over the widespread dissemination of asbestos about construction sites. This led to attempts to control spraying of asbestos through procedural regulations in New York City[2] and elsewhere. As these were found ineffective, the spraying of asbestos materials was prohibited by several cities and states in 1970 and 1971 (Boston, New York, Philadelphia, Illinois, e.g.)[3] and nationwide by the United States Environmental Protection Agency in 1972.[4]

3. HEALTH EFFECTS ASSOCIATED WITH ASBESTOS EXPOSURE

Asbestos, including its major commercial varieties, chrysotile, amosite, and crocidolite, has been found to produce significant disease among workers occupationally exposed in its mining and manufacturing, and in the use of materials containing the fiber. The predominant route of exposure has been inhalation, although some asbestos may be swallowed directly or after being brought up from the respiratory tract. Diseases associated with asbestos exposure include asbestosis, a non-malignant scarring of the lungs; bronchogenic carcinoma (lung cancer); mesothelioma, a tumor of the lining of the chest and lungs or of the abdomen; and cancer of the gastrointestinal tract (esophagus, stomach, colon, rectum). Not only have such diseases been found among individuals exposed to asbestos ("asbestos workers") directly as a result of excessive work exposures, but asbestos-associated cancer has also been identified, albeit less frequently, among those with inhalation exposures of lesser intensity, including those who had worked near the application or removal of asbestos material, those with history of residing in the vicinity of asbestos plants, or in those who had lived in the household of an asbestos worker.

a. Occupational Exposure Effects

The full spectrum of disease from asbestos exposure is perhaps best demonstrated by the data of Selikoff, Hammond and Seidman concerning the mortality experience of 17,800 asbestos insulation workmen observed by them.[5] Table 1 shows the expected and observed deaths among this group of workers from January 1, 1967 through December 31, 1976. Among the 2,270 individuals who died, 44 percent died of cancer, with one in five deaths due to lung cancer, one in ten from gastrointestinal cancer, and more than 7% from mesothelioma (a tumor otherwise so infrequently found in the general population that it may account for only one in ten thousand deaths in the absence of exposure to asbestos). Additionally, seven percent died of asbestosis. Comparing the frequencies of deaths from cancer and asbestosis in these workers with those among the general population, nearly 40% of the deaths in this group of workers can be attributed to their occupational exposure to asbestos.

Asbestos related disease has also resulted from exposures in asbestos factories. A study of production employees of the largest asbestos products manufacturing facility in the United States again demonstrated the presence of significant excess disease.[6] In this study, the mortality experience of all 689 individuals who were working on January 1, 1959, and who were first employed prior to 1939, was analyzed. From 1959 to 1976, it was expected that 188 deaths would have occurred in this group. Instead, 274 died, 46% more than anticipated. About 40 cancers were expected; 99 were observed. As shown in Table 2, the anticipated asbestos-related tumors were found in excess -- bronchogenic carcinoma, mesothelioma, and gastrointestinal cancer.

b. Lapsed Period with Asbestos Disease

One of the more important aspects of asbestos related disease is the occurrence of a long lapsed period from onset of exposure to the appearance of clinical illness. Data from the previously described group of insulation workers illustrates this fact clearly. A significant rise in the number of cases of lung cancer occurred only after 25 years from first exposure. In the case of mesothelioma the majority of cases are found after 30 years (Figure 1). It is useful to note that current disease is largely the result of exposures decades ago. At that time, few or no dust measurements were made and we know little about the intensities of the exposures in the 1930's, 1940's and 1950's, which have led to the disease we are now seeing. In the same vein inadequate control of exposures now may lead to disease 20, 30 or 40 years hence. Unhappily, if it does occur, it generally is fatal since current therapies for these illnesses are ineffective.[7] Thus, prudence would suggest that human health risks in the future be minimized through the elimination of any avoidable asbestos exposure at the present time.

c. Synergistic Effects with Occupational Asbestos Exposures

A second important concern is increasing evidence that many cancers may have a multiple factor etiology. For example, lung cancer in asbestos workers is strongly associated with cigarette smoking. In the large cohort of 17,800 insulators observed by Selikoff and Hammond, the smoking habits were obtained on the majority of workers in 1967.[8] Table 3 illustrates the effect of cigarette smoking on lung cancer mortality of these workers. Among 2,066 non-cigarette smokers, only eight lung cancers were seen in a ten year period, where 1.82 were expected, based on American Cancer Society data on the risk of lung cancer death in non-smokers. Inhalation of asbestos by insulators appears to multiply the risk by four or five times. Considering the data for men with a history of smoking, among 9,591, 325 deaths were observed versus 66.78 expected, also a fivefold increase. However, since cigarette smokers already have a ten to twenty times greater risk of lung cancer death than non-smokers, (depending on cigarette consumption), the multiplicative effect of the asbestos exposure increases the lung cancer risk up to 100 times for smoking asbestos workers compared to non-smokers unexposed to asbestos. This was also shown by the experiences of a cohort of New York and New Jersey insulators.[9] Here, it was estimated that the risk of dying of lung cancer for cigarette-smoking asbestos workers was more than 90 times that of individuals who neither smoked nor worked with asbestos.

d. Indirect Occupational Asbestos Exposure

In 1968 it was pointed out by Harries that shipyard workers other than insulators were at risk from asbestos disease.[10] Among Devonport Dockyard employees, five cases of mesothelioma were found among men who had not been "asbestos workers" but had followed other trades in the yard. These men presumably had been inadvertently exposed to asbestos merely by working in the same shipyard areas where asbestos had been used. Continuing to follow this group, Harries later documented 55 cases of mesothelioma in this shipyard alone, only two of which occurred in asbestos workers[3], one, a man who had previously sprayed asbestos. A study of the distribution of all verified cases of mesothelioma found in Scotland between the years of 1950 and 1967 is also revealing.[12] Of 89 cases available for study, 55 were in shipyard employees, dockers or naval personnel. Of the 55, again only one was an asbestos insulation worker.

A third important study of workers in British shipyards is that of John Edge, who reviewed x-rays of former shipyard workers in Barrow.[13] A prospective study was conducted of 235 men whose x-rays, taken between 1955 and 1969, showed abnormalities characteristic of asbestos exposure (pleural plaques, scarring of the covering of the lung or lining of the chest), but no parenchymal fibrosis (scarring of the lung tissue). Most of these x-rays were of individuals (riggers, welders, carpenters, electricians, machinists, steamfitters, etc.) who had not worked directly with asbestos, but who could have sometimes been nearby when asbestos was used. In tracing the individuals who had such x-ray changes, it was found that 70 had died from 1970 to 1973. Of these 70 deaths, 13 were of lung cancer, two and one-half times the number expected, and 17 were of mesothelioma (none, of course, were anticipated).

e. Environmental Asbestos Disease

In 1960 Wagner reviewed 47 cases of mesothelioma found in the Northwest Cape Province, South Africa in the previous five years.[14] Of this number, roughly half were in people who had worked with asbestos. Virtually all of the rest, however, were in individuals who had, decades before, simply lived or worked in an area of asbestos mining (one lived along a roadway in which asbestos fibers were shipped). This germinal observation demonstrated that asbestos exposure of limited intensity, often intermittent, could cause mesothelioma. The hazard was further pointed by the findings of Newhouse[15], who showed that mesothelioma could occur among people whose potential asbestos exposure consisted of their having resided near an asbestos factory or in the households of asbestos workers. Twenty of 76 cases from the files of the London Hospital were the result of such exposure, 31 were occupational in origin and asbestos exposure was not identified for 25.

A recent extensive study of the effects of household exposure has been conducted by Dr. Henry Anderson and his colleagues of the Mount Sinai School of Medicine.[16] In a clinical survey of 489 family contacts of former factory workers, it was found that the x-rays of 36.2% of these individuals showed abnormalities characteristic of asbestos exposure. It did not matter greatly what the relationship to the worker was; the asbestos dust in the household could affect any resident -- wife, sons, daughters, parents. While almost all were currently asymptomatic, and while most would perhaps suffer no impairment from their past exposure, others may be stricken with an asbestos-related cancer as a result of past household asbestos exposure. During the initial phase of the survey four dealths of mesothelioma had been identified in this group of family contacts.

4. ENVIRONMENTAL ASBESTOS AIR CONCENTRATIONS

In occupational environments asbestos air concentrations are determined by counting all fibers longer than five microns collected on a portion of a filter.[17] As phase contrast light microscopy is utilized, no identification can be made of the fiber types nor even whether they are mineral or organic. A further limitation of the technique is that shorter fibers are not enumerated, although they may constitute more than 99% of the total aerosol by number.[18] To overcome these technical disadvantages, electron microscopic techniques are utilized for the determination of asbestos in the ambient air. These allow observation of fibers of all sizes and can determine the asbestos mineral species on the basis of morphology (chrysotile) or of electron diffraction techniques and electron microprobe analysis (amosite, crocidolite, anthophyllite and tremolite). In practice chrysotile is usually the only variety quantitated as it is the dominant asbestos mineral used in the United States (it constitutes 95% of U.S. asbestos use[19]) and its identification, because of its characteristic appearance, is much less time consuming. Further, as other asbestos minerals are usually used in conjunction with chrysotile, the latter can serve as a monitor of contamination for many asbestos containing products and asbestos uses.

During analysis of ambient air samples for asbestos, the presence of other organic and inorganic material presents significant analytical problems. Typical urban air may contain 100 micrograms/cubic meter (mg/m^3) of "suspended particulates".[20] Such material is generally of respirable size (less than 10 microns in diameter) and may include 25-50% inorganic matter. In contrast, typical urban chrysotile asbestos concentrations range from about 0.1 nanograms/cubic meter (ng/m^3) to perhaps 100 ng/m^3.[21] Analysis of a limited number of samples of urban air from Chicago, New York and St. Paul for other asbestos varieties has shown them to be present at concentrations lower than those of chrysotile.[22] Thus, asbestos may constitute only 0.0001 to 0.1% of the particulate matter present in a given air sample. Moreover, the asbestos fibers found in the ambient air tend to be very small; while some are microns in length, many more are individual fibrils with diameters of only 20 to 50 nanometers and lengths as short as 100 nanometers. In many instances, too, these fibers and fibrils may be agglomerated with a variety of other materials present in the air sample.

These considerations preclude the possibility of complete quantitative analysis of such ambient air samples by light microscopy. Further, bulk spectroscopic or x-ray diffraction techniques have not been effective in determining chrysotile concentrations at the levels of concern in the ambient air because of the presence of the much greater quantity of other inorganic material. Thus, electron microscopic techniques are the analytical procedure of choice. Various procedures have been developed by different laboratories.[23,24,25] Those used for the determination of chrysotile air concentrations in this study are described in detail in Appendix 1.

a. Outdoor Chrysotile Asbestos Concentrations

Asbestos of the chrysotile variety has been found to be a ubiquitous contaminant of ambient air. A study of 187 quarterly composite samples collected in 48 United States cities during 1969 to 1970 showed chrysotile asbestos to be present in virtually all metropolitan areas.[21] Table 4 lists the distribution of values obtained in that study. Each value represents an average of from five to seven 24-hour samples and thus averages over possible peak concentrations which could occur periodically or randomly. A second set of ambient air analyses is also shown for comparison.[26] These studies utilized different analytical techniques but the results agree well. Of the three samples greater than 20 ng/m^3 analyzed by Mount Sinai, one was in a city having a major shipyard and another in a city that had four brake manufacturing facilities. Thus, these samples may include a contribution from a specific source in addition to that of the general ambient air. It should also be noted that three other quarterly samples in these three cities were considerably lower (< 20 ng/m^3) and similar to values measured in other cities. What is important, though, is that the majority of U.S. cities have measurable asbestos concentrations using the analytical techniques of these studies. Concentrations below 0.3 ng/m^3 were found for some samples in this 48 city study and might have occurred from background contamination during sample processing. Therefore, one cannot state unequivocally that all U.S. cities always have some chrysotile fibers, however few, in the ambient air. Such may likely be the case, though, if sufficiently sensitive quantitative analytical techniques are utilized. The origin of chrysotile in our air could arise from man's activities, or from natural sources, such as erosion into the environment of serpentine rock formations containing the mineral.

Similar data have recently been forthcoming from France, providing evidence of the presence of chrysotile in the ambient air of Paris.[27] These data are listed in Table 8.

In a study of the ambient air of New York City, in which samples were taken only during daytime working hours, higher values than those mentioned above were obtained.[28] These were six-to-eight hour samples collected between 8:00 A.M. and 5:00 P.M., and reflect what could be intermittently higher concentrations during those hours compared to night time periods, for example. Table 5 records the chrysotile content of 22 samples collected in the five boroughs of New York. It should be noted that the samples analyzed in all of the studies discussed above were taken during a period when fireproofing highrise buildings by spraying asbestos-containing materials was permitted. The practice was especially common in New York City. While no sampling station was known to be located adjacent to an active construction site, unusually high levels could nevertheless have resulted from the procedure.

To determine if construction activities could indeed be a significant source of chrysotile fiber in the ambient air, six-to-eight hour daytime sampling was conducted in lower Manhattan in 1969 about sites where extensive spraying of asbestos-containing fireproofing material was taking place.[28] Table 6 shows the results of this sampling and demonstrates that spray fireproofing can contribute significantly to asbestos air pollution. In some instances, chrysotile asbestos levels approximately 100 times the concentrations typically found in the ambient air were observed.

b. Indoor Chrysotile Asbestos Concentrations

Of particular relevance to the current study are the analyses for chrysotile of 116 samples of indoor and outdoor air collected in or near 19 buildings in five United States cities.[29] The buildings sampled included those in which various asbestos minerals had been applied as fireproofing material to the steelwork or for acoustic or decorative purposes. As virtually all sprayed-asbestos formulations contain chrysotile, it served as a marker for contamination from such products. Table 7 lists the average chrysotile concentrations of indoor and outdoor air in different buildings grouped by type and use of insulation material. Considerable variability existed in the air concentrations measured in the various buildings. Average values for the air inside buildings ranged from 2.5 ng/m^3 to 200 ng/m^3, with individual measurements ranging from 0 to 800 ng/m^3. For the outside air, the variation for the average concentration at a given site extended from 0 to 48 ng/m^3.

While no evidence of generalized contamination was found in buildings having sprayed asbestos materials applied for decorative or acoustic purposes, three rooms of buildings with acoustic spray had fiber concentrations exceeding 100 ng/m^3, suggesting localized air contamination. Additionally, incidents of contamination of buildings with such asbestos use have been reported elsewhere with even higher levels of air contamination.[27] In those circumstances where contamination was observed in the 19 building study, visible damage to spray materials was also evident.

On the other hand, more widespread contamination was evident in buildings in which asbestos fireproofing material was applied to the structural steel surfaces in return air plenums. This is shown graphically in Figure 2 in which the percentage of samples within several concentration ranges is depicted. Here it can be seen that the air of those buildings in which the fibrous spray fireproofing had been used had considerably more samples in excess of 20 ng/m^3 than either the buildings in which cementitious spray had been used or in control samples (samples in buildings without asbestos or of outside air).

Sampling has also been done in homes of asbestos insulation workers and asbestos mill employees in order to determine the asbestos air concentrations in such homes. The sampling and analysis procedures were identical to those used in the previous study. Results indicated that air levels in the homes of asbestos workers can range from 100 ng/m^3 of air to as high as 5,000 ng/m^3 of air.[30]

Table 9 summarizes the ranges of chrysotile concentrations in the variety of environmental and occupational circumstances discussed above. The concentration ranges are only approximate and, in most cases, are limited because of the limited number of samples taken in given circumstances. Extension to higher and lower concentrations would be expected with the availability of more data. However, the results presented in Table 9 reflect the data referenced previously in this report as well as unpublished data of the Environmental Sciences Laboratory. While disease has been associated with some of the circumstances listed in Table 9 (home exposures), these data, obtained between 1969 and 1977, may not necessarily represent concentrations about factories or in the homes of workmen decades ago. In the absence of measurements decades ago, we can only conjecture what concentrations of asbestos might have been. Without such data, we must be guided by those current measurements we have.

5. ASBESTOS IN NEW JERSEY SCHOOLS

The widespread use of asbestos materials for fireproofing high rise office buildings or for decorative and acoustical purposes in other public buildings has been mentioned. Several years ago, attention was attracted to its presence in schools, and to the associated potential health hazards. Damage to asbestos coated surfaces was seen, with friable materials found flaking and contaminating large areas, in a grade school in Wyoming[31], a university dormitory in California[32] and in the Yale School of Arts and Architecture in New Haven.[33] In both the Wyoming school and the Yale Library air measurements by optical microscopy for asbestos showed concentrations that in some circumstances exceeded the then existing occupational standard of 5 f/ml. In the case of the Yale Library detailed documentation has been provided on asbestos exposures before, during and after removal of the insulation material.

In the fall of 1976, loose flaking sprayed asbestos was seen in a school of Howell Township, New Jersey, leading to its removal and to further concern about the presence of deteriorating asbestos in other school buildings in New Jersey. As a consequence, the New Jersey Department of Education requested that school districts report the presence and condition of asbestos surfaces in all school buildings within the state. Responses, listed in Table 10, revealed that 265 schools in 142 districts had nearly three million square feet of what they considered to be asbestos material in classrooms, auditoriums, hallways and other rooms accessible to pupils.[34]

To verify the accuracy of these reports and to investigate the condition of asbestos surfaces in the schools, selection was made of 21 school districts in which schools with sprayed-on asbestos material would be visited. The selection was accomplished using random numbers, but also employed a weighting factor to include more of those school districts which had reported greater use of asbestos.

Forty-eight schools were visited and samples were taken of the material thought to be asbestos. These were analyzed for their asbestos content and for the presence of other mineral materials. Areas such as classrooms, hallways, auditoriums, cafeterias and locker rooms were priority locations for sampling, since they are used by large numbers of students as well as by faculty. In general the suspect material was on ceilings, although they might also have been applied to walls. Of 64 samples collected, 50 were in such areas, the remainder being from custodial or boiler rooms.

Analysis of the samples was accomplished using standard x-ray diffraction and optical microscopic techniques described in Appendix 2. The results are shown in Table 11. In only two of the 64 collected samples was the presence of asbestos not confirmed. Chrysotile was the most common asbestos mineral found, being present in 58 samples. In 72% of the samples in which chrysotile was found, it was present in concentrations greater than 5%. About one-third of the samples had more than one asbestos mineral present, with tremolite and anthophyllite being common constituents. They were always found with talc. This is a consequence of the typical co-mingling of these three minerals in various ore bodies.

Many samples consisted of a mixture of rock wool and asbestos fibers, with rock wool being the major constituent. In others, non-fibrous binder materials were present, including plaster (either as plaster of paris or gypsum, hydrated forms of calcium sulphate), vermiculite (an exfoliated, low density mineral similar to mica), perlite (a low density expanded volcanic glass), and clay. Cellulose as macerated paper or wood pulp was also found in some samples.

During visual inspection of these schools and the analysis of collected samples, three general types of asbestos containing material were found. One was a friable, loosely-bonded, fibrous mat approximately one-half inch thick. The mat had been applied by blowing a mixture of asbestos, mineral (rock) wool, clay binders (as, bentonite), adhesives, synthetic resins and other proprietary agents through a two-four inch diameter hose. Upon leaving the hose, the material passed through a water spray which activated the adhesives and binders. The applied material would then have been tamped and often sprayed with emulsion type sealers -- latex or acrylic paints. Most material of this type observed in this survey was readily damageable and could also break loose from the underlying surface because of the inadequacy of the binders. In the schools visited, the most troublesome problems were those seen with this type of material and its application. Figures 3 and 4 illustrate extreme examples of damaged and deteriorating sprayed-on asbestos ceilings. Approximately one-third of the student areas visited had this type of material applied. Its use in boiler rooms and custodial areas was considerably greater, however.

A second type of application involved the mixing of asbestos in a slurry, often with other products such as vermiculite. This would be applied in the wet state to walls and ceilings, compacted and formed into a relatively smooth matrix. This material would also usually be over-painted, either shortly following application or subsequently. In the schools we visited spontaneous disintegration of such materials was not seen. However, in areas accessible to students, various degrees of abuse were observed. Instances of damage are shown in Figures 5 and 6.

The third type of application involved the mixing of asbestos into a cementitious or plaster-like matrix. This is applied as a slurry to walls and ceilings, forming a textured surface of considerable hardness which would usually be over-painted. Such plasters or textured paints have considerable stability and are unlikely to allow the release of asbestos fibers through erosion. Although damage to these surfaces can occur from physical abuse or abrasion, this was infrequently seen.

In each school visited the asbestos material was categorized as above and an estimate made of damage. Results are outlined in Table 12 with the school and district numbers corresponding to those of Tables 10 and 11. As can be seen, the severest problems of damage and release of asbestos fibers occurred in those areas in which loose, friable fibrous spray material had been applied. Nevertheless, damage to other asbestos materials occurred and was evident in many schools that had not categorized their material as "flaking asbestos."

This survey and x-ray analysis of materials, by and large, confirmed the presence of asbestos in those schools that had reported its use. In 97% of the schools that believed their sprayed-on material contained asbestos, such was the case. In only two schools was the reported presence of asbestos not confirmed by x-ray diffraction analysis of the sampled material. On the other hand, this survey did not provide information on the number of schools which may have been mistaken in their belief that they had no asbestos in surfacing material, and, as a result, did not report its presence. That this possibility exists is exemplified by one instance in which a school official stated that his administration had been told by its architect that the sprayed-on plaster material in their school was asbestos free. An analysis of the material, however, revealed that it contained about 2% chrysotile.

The request of school superintendents by the New Jersey Department of Education for information on asbestos use focused on potential pupil exposures from sprayed-on asbestos. The possibility also exists that pupil exposures from degraded asbestos-containing thermal insulation might also occur. This was found to be the case in one school visited for other purposes by Environmental Sciences Laboratory personnel. No report indicated that this particular school district had asbestos present in any school area accessible to pupils. However, deterioration had occurred to some asbestos containing pipe-covering of a degree requiring corrective action (see Figure 7).

As systematic sampling of the more than 2000 schools in New Jersey which did not report the presence of asbestos was beyond the scope of this project, it can only be emphasized that some under-reporting of the presence of asbestos can have occurred and the amount of asbestos in New Jersey schools as reflected in Table 10 may well be an underestimate. The finding that more than 10% of schools in the State had asbestos present and that, of those visited, many had visible damage, indicates the potential scope of the environmental asbestos problem in New Jersey schools.

6. ANALYSIS OF AIR SAMPLES COLLECTED IN SCHOOLS FOR CHRYSOTILE

a. Air concentrations during normal conditions

Air samples were collected in three New Jersey schools while they were in session to determine the asbestos concentrations present. The schools selected had visibly damaged asbestos-containing materials on hallway or classroom ceilings. This condition made them candidates for remedial action which might be undertaken as part of a feasibility study of sealant application or asbestos removal. The results of this sampling and analysis are shown in Table 13 and provide an example of the levels of asbestos exposure that might be experienced from the more serious deterioration of asbestos containing sprayed-on material. These chrysotile asbestos concentrations compare to those found in the other circumstances of environmental contamination discussed previously (see Table 9). It is to be expected, as with other buildings, that schools with very little damage would have lower asbestos air concentrations and those with undisturbed, intact sprayed-on material would have concentrations little different from those of the ambient air.

In the first school sampled (District 9, School 1), a small amount of asbestos had fallen to the floor in one of the hallways. After two groups of students had passed, this was carefully swept up by a janitor. A sample taken over a one hour period while this occurred showed a chrysotile concentration of 320 ng/m^3 of air. In the second school (District 20, School 1), while the applied asbestos was damaged, no debris was seen on any floor in the building. Nevertheless, asbestos concentrations were significantly different from background ambient air (Table 4). In the third school, with a small amount of water damage to the sprayed ceiling, ten minute samples taken during general sweeping of the hallways revealed the presence of considerable asbestos in the air even though none was seen on the floors prior to the custodial activity. While this air sampling program was of limited extent, it did reveal that in those circumstances where there was evidence of damage, concentrations of asbestos significantly above background can be present in the air.

The above findings are substantiated by data obtained in other schools in other circumstances. During 1974, sampling at the Yale Art and Architecture Building revealed high asbestos concentrations to be present due to dislodgement of the fiber from ceiling surfaces coated with an asbestos-mineral wool mixture.[33] Table 14 lists concentrations determined in this building using optical microscopy. The finding of significant asbestos air concentrations stimulated remedial action to remove all sprayed-on asbestos containing material.

Unpublished data obtained by the Environmental Sciences Laboratory as the result of sampling and analysis for chrysotile asbestos in one school in Massachusetts and three in New York City also revealed significant asbestos air concentrations to be present.[35] Table 15 lists the values obtained in these studies under different conditions of sampling. Following the finding of asbestos contamination in the Massachusetts school, sprayed-on asbestos material accessible to students was enclosed by covering it with wallboard. Later measurements demonstrated the effectiveness of this procedure.

Data obtained by Sebastien et al. in sampling studies, in Paris, have also revealed chrysotile asbestos air concentrations in schools much above those of typical ambient air.[27] Table 16 lists the data obtained in that study.

b. Air Concentrations During Simulated Conditions of Abuse

During the summer of 1977, in two schools in which extensive damage was visible and for which remedial action was scheduled, activities were undertaken to simulate the abuse that might have given rise to the evident damage present. These activities are described in Table 17 together with the concentrations of asbestos found. The asbestos air concentrations, during short periods of time, were comparable to those found in occupational settings. Following any such disruption of asbestos during school sessions, normal pupil movement through the hallways could continue to disperse asbestos into the air and it would be expected that the air concentrations in such circumstances would exceed those listed in Table 13, where little or no asbestos was visible during the situations sampled.

c. Conclusions from Air Sampling Data

The majority of the data described above were obtained in circumstances in which damage had occurred to friable, non-cementitious asbestos-mineral wool sprayed material with consequent dislodgement of asbestos fibers. In general, when significant levels were found, physical deterioration of the surface of the material was evident. While fewer data exist regarding air concentrations associated with damage to cementitious asbestos-containing sprayed material, the finding here of higher chrysotile concentrations in one school with such material and the measurement of significant concentrations under simulated abuse conditions raises the same question here as well. Thus, the conclusions that can be drawn from these data include:

1) if visible damage to or erosion of any asbestos containing sprayed material is evident, increased asbestos air concentrations would have existed at the time of damage and may still persist.

2) As such damage is likely to reoccur or to continue, asbestos air concentrations in excess of background (< 50 ng/m^3) may be expected in the future.

3) Where visible damage or erosion is not evident, asbestos air concentrations are likely to be little different from background, but the possibility of later damage and future asbestos fiber release with concomitant increased air concentrations cannot be excluded.

7. ASBESTOS CONTROL TECHNIQUES

As noted in Section II, health effects cannot be unequivocally ascribed to asbestos air concentrations in the range of 100-1000 ng/m^3, as found in the New Jersey schools sampled and in other buildings with similar conditions. Furthermore, it is unlikely that a clear association of such levels and the presence or absence of asbestos disease will be made in the foreseeable future. This is the result of the lack of measurements of air concentrations in the past and the need to follow very large populations exposed at lower levels for appropriately long periods of time to evaluate such quantitative exposure-disease associations. However, this absence of dose-response data at lower exposure levels (non-occupational) also precludes our having knowledge of a threshold for asbestos-cancer (as for carcinogens in general). Thus, "the prudent person" approach would indicate that, at the least, where feasible, excess asbestos exposures be controlled. At the moment, we do not know how little asbestos is needed to increase the risk of cancer. As a guide for the development of public health measures needed to prevent such disease, it will be necessary to keep air concentrations below those which were obtained in households of asbestos workers in the past.

The feasibility of two methods of control of asbestos exposures in schools was investigated; the complete removal of asbestos containing materials, and the "sealing" of such material by an appropriate covering agent. A third procedure, that of enclosing the asbestos with other building products also may be appropriate in particular, limited, circumstances. The focus in this feasibility project was on materials and procedures for sealing asbestos-containing materials with an appropriate coating, and on procedures for completely removing the asbestos material. In each case, effectiveness was measured by reduction of asbestos air concentrations.

a. Sealing Asbestos Containing Materials

While asbestos stripping or removal procedures provide a solution, they also cause significant interruption of normal activity. Moreover, they usually require the replacement of the asbestos containing material with other building products designed for the original purpose, usually sound control or fireproofing. Sealants, on the other hand, have the advantage of reducing the disruption of routine activities, and their use may obviate the need for replacement of the sprayed asbestos material. However, the use of a sealant also means retention in the school of the original asbestos material. This may present a problem later if the sealant undergoes erosion with time, and only postpones removal of the asbestos until the time of major building renovation or demolition. The use of sealants is sometimes further restricted by the condition of the sprayed asbestos material and the structural substrate onto which it had been applied. As the integrity of a sealant system depends ultimately upon the adherence of the sprayed-on asbestos material to the underlying supporting structures, a failing sprayed asbestos coating, with poor adhesion to the underlying surface, may undergo subsequent delamination even after the application of a sealant. Finally, possible subsequent damage to the sealants used on asbestos surfaces under conditions of building use must be considered in fully evaluating their usefulness.

i. Characteristics desired

Sealants used for the coating of asbestos material should:

1. Form an effective seal against fiber dissemination by adhering to the fibrous substrate.
2. Adequately penetrate into the asbestos material to prevent shearing and separation of the sealant from the asbestos material. Ideally, penetration should be sufficient to provide additional bonding to the underlying structural materials.
3. Resist external impact to protect the underlying sprayed asbestos material.
4. Possess high flame retardant characteristics and low toxic fume and smoke emission ratings. This, of course, is essential if the original purpose of the sprayed asbestos material included fire retardation and protection of structural material.
5. Possess enough flexibility to accommodate atmospheric and structural changes and deformation.
6. Utilize application techniques in which workers can be easily trained.
7. Be neither noxious or toxic to application workers or users of the structure thereafter. Since spraying may

cause fiber dissemination, containment by barrier systems is desirable during application. However, this exacerbates any problem if the sealant or its solvent releases toxic vapors.

8. Be impervious to water and resistant to common cleaning agents.
9. Have resistance to weathering and aging.
10. Be acceptable by architectural and esthetic standards.

How these characteristics are ordered in importance depends upon the specific application. Sealant selection and application should be made with consideration of the configuration, dimensions, use and characteristics of the building structure involved.

The problem of physical damage to the sealant material should not be underestimated. Nearly any sealant will reduce fall-out from surface erosion but a truly effective coating must also minimize the possibility of subsequent contamination due to dispersal of fibers by damage. Even with sealants resistant to damage, periodic reexamination should be conducted to monitor possible physical damage, with repair of any found.

ii. Selection of sealants

During the course of this feasibility project, twelve sealants were reviewed before a final choice was made. These fell into five classes of materials: 1) latex paints, 2) vinyl or butyl polymers, 3) silicacious plaster emulsions, 4) epoxy-materials and 5) inorganic silicates mixtures. Samples of the various material and technical information was solicited from manufacturers. Available data on weathering, aging, flame spread and combustion, water vapor transmission characteristics, tensile strength and resistance to puncture were reviewed. However, for many materials, the requisite information was unobtainable. In addition, existing applications of sealants already used were inspected in schools, libraries, office buildings and other structures in New York, Connecticut and New Jersey. In selecting sealants for use in this feasibillity project, greatest emphasis was placed on those having high surface impact resistance and high penetrability into the asbestos matrix during application.

Our review of the specifications and properties of sealants was limited to those readily available in the mid-Atlantic region at the time of this project. Moreover, it cannot be considered to have been complete with respect to all twelve of those reviewed. Much information desired was simply unavailable from the manufacturers of many of the agents. Of those reviewed, however, several had properties suitable for use in this project, and two were selected for application in two New Jersey schools. One was a water-based vinyl polymer which was applied over primer material by an airless gun. The second was an inorganic silicate material applied by a low pressure airless gun directly to the asbestos surface. Following drying, a final coating of silicone was applied.

iii. Application procedures

Application of a sealant by spraying may cause dissemination of small fibers at the point of impact of the vehicle stream onto the asbestos surface. The primary coat of a sealant system should be applied with caution and at as low a pressure as feasible. Furthermore, prior to the application of a sealant coat, damaged asbestos material should be patched by the application of spackle, plaster, or other appropriate material. During these activities significant concentrations of asbestos fibers may be released, giving rise to worker exposures possibly above the OSHA standard. This would then require protection of workers by appropriate respirators and complete enclosure of the work area. Further, clothes changing and shower facilities are necessary for decontamination of workers following the spray application.

iv. Experiences with sealing

The first school (District 20, School 1) selected for the investigation of the feasibility of sealing asbestos had approximately 5,100 square feet of ceiling sprayed with a cementitious type asbestos-vermiculite mix. The area to be covered included hallways, a gym entranceway and offices, locker rooms and a storeroom. The asbestos material was adhering well to the substrate. However, there had been both extensive inadvertent and deliberate damage by students while the building served as a high school. One source of damage had been the use of a hallway by a band color guard unit to practice its maneuvers, during which flagpoles would often strike the ceiling. The school now serves as a middle school, and the major source of damage to the hallway ceiling is no longer present. Figures 5 and 6 show some of the damage.

This school was felt to well represent the use of cementitious type asbestos mixes. Applications of such material in buildings usually adhere well to the underlying substrate, and are relatively impervious to damage. Here, however, as sometimes happens, extensive damage had occurred. An extreme case was selected, since the demonstration of usefulness of sealants in such circumstances would indicate its applicability to a wide range of other buildings with lesser damage.

As each of the areas with asbestos materials directly connected to locker rooms, shower facilities were at hand for decontamination of workers. The areas to be sprayed were enclosed with plastic (Figure 8) to contain any release of asbestos fibers and to control the overspray of sealant material. After enclosure, all damaged areas of the ceiling were patched by spackle, providing a relatively smooth surface for the later application of a coating (Figure 9). Following preparation, a primer and two coats of a vinyl polymer sealant were applied using standard airless spray equipment (Figures 10 and 11). All overspray by the prime or final coating was contained by the plastic enclosure. At the conclusion of the work the workers removed their disposable clothing and showered prior to entry into the rest of the building. All waste material was bagged in plastic containers and disposed of as appropriate for asbestos. A listing of approved sites for the disposal of asbestos waste is maintained by the New Jersey Department of Environmental Protection. The final appearance was that of a smooth plastic surface impervious to physical impact.

During and following this work air samples were taken and analyzed to determine if dissemination of asbestos from the work areas had occurred and if environmental contamination remained after the sealing and clean-up operations. Air samples collected outside the work area during spraying and analyzed by optical microscopy showed fiber concentrations to be less than 0.1 fiber/ml (see Table 18).

This school was visited one month later in order to assess the integrity of the material and to take air samples during normal student use. Some very minor damage had occurred to the coating material, caused by students who had struck the new coating surface with their fists. This produced several slight indentations into the compactable, coated asbestos matrix. The coating, however, remained intact, suffering only tiny cracks at one of the points of impact. Two air samples taken at that time in the school revealed air concentrations of 80 and 340 ng/m^3. As the slight damage observed could not account for these elevated readings, the possibility of sample contamination by an extraneous source cannot be ruled out. A second visit to the school was made to repeat the air sampling and asbestos concentrations were found at that time were typical of ambient air (< 50 ng/m^3) (see Table 19).

The second school (School 3, District 72) selected for testing the feasibility of sealing asbestos was an elementary school which had approximately one-half inch thick loosely compacted fibrous spray applied to the ceiling of a large multipurpose room. The area could be divided into three sections, one of which was used as a music room and the others as gym areas. In this latter use, balls thrown by pupils would occasionally hit the ceiling and dislodge some of the asbestos, which had been applied to wallboard. Where there had been no external damage, the adhesion of the asbestos to the wallboard was relatively good, although some flaking could be observed. The sealant selected for use here had in previous applications shown a high degree of penetrability into the asbestos matrix and had given a surface with significant impact resistance.

The application at this second school proceeded by enclosing the two areas to be sprayed in plastic tarpaulins, constructing a double barrier between the spray area and a decontamination area and, in turn, separating this latter area from the rest of the school. Figure 12 illustrates the enclosure system schematically. In order to minimize worker discomfort in the sealed area from the lack of ventilation during the summer time, an exhaust system was constructed to remove air from the work area through a filter and electrostatic precipitator. This provided a slight negative pressure and further helped to prevent the spread of any dislodged asbestos fibers. Figure 13 shows the general enclosure of the area and Figure 14 illustrates the double barrier doorway between the enclosed area and shower area. All work clothes were removed in this doorway area by a worker before he proceeded to the shower area for decontamination and change to street clothes. As with the first spray installation, workers wore disposable overalls and half-face mask respirators (Figure 15). The filters were replaced daily or more frequently if necessary and disposed of as asbestos contaminated waste at the end of the project.

Following the enclosure of the room and the fixtures within it, all damaged areas of the asbestos ceiling were patched prior to application of the coating material (Figure 16). The application was a two step process; the first involved the spraying of an inorganic silicate material and the second an overspray of a silicone coating (Figure 17). Special emphasis was placed on applying sufficient sealing material to provide penetration through the asbestos and additional bonding to the wallboard substrate. Following completion of the work a very rigid surface was obtained, felt to be sufficient to withstand the impact of balls thrown by children during gym activities. Measurements of asbestos concentrations during the enclosure of fixtures, the spraying of ceiling material and in the school during work activities are shown in Table 18. As can be seen, there was minimal dissemination of asbestos fibers either into the work area or into the school. Table 20 lists the data obtained after completion of work. Chrysotile air concentrations similar to those of ambient air were observed in all measurements.

Two months after the completion of work in this school surface coating of the sealant material cracked for undetermined reasons. Movement of the asbestos in some areas following this cracking resulted in delamination of several areas from the underlying substrate. This occurred over approximately 10-20% of the sprayed area, where inadequate penetration of the sealant had failed to provide adequate bonding to the wallboard. Over the remaining 80% of the ceiling surface this bonding was achieved and the material adhered well, although surface cracking was present. The area was closed and the contractor removed the asbestos after sealing the rooms with plastic tarpaulins. During removal, in which extensive wetting with amended water (see Section 7) was undertaken, room air concentrations rose to as high as 15 fibers/ml in contrast to concentrations of about 2 fibers/ml maintained during removal of loose asbestos. This was the result of extreme difficulty in removing much of the material from the wallboard, and by the barrier provided by the sealant to the water used for wetting. Over much of the area, the asbestos could only be removed with the aid of a hammer and chisel. Following the removal of the asbestos from the multipurpose rooms, all areas were thoroughly washed and acoustical ceiling tiles were glued to the ceiling area. Chrysotile asbestos air concentrations measured in the areas following completion of the work averaged 45 ng/m^3 (Table 20).

v. Summary of Sealing Procedures

In general, sealing of firm, intact, cementitious asbestos materials proceeded smoothly with no measureable dissemination of asbestos fibers into adjacent school areas. A thick, relatively impermeable coating was applied to asbestos material that adhered well to the substrate. The new coating was apparently tested for effectiveness by students who struck it with their fists and produced indentations and tiny cracks of a minor degree. Whether this damage contributed to higher asbestos concentrations measured in one of two sampling studies is uncertain. However, such a possibility exists and future damage by more vigorous abuse, producing transient episodes of contamination, cannot be excluded.

An attempt to seal loosely-bonded, fibrous asbestos materials was not successful although a hard, impervious surface was obtained, spontaneous cracking led to separation of the coated asbestos material from the underlying substrate. While this project failed to demonstrate the feasibility of sealing loosely-bonded asbestos material that is subject to external abuse, it cannot be ruled out that sealants (either existing or developed in the future) other than that used in this study may be more effective. At the present time, however, to the extent that our experiences apply, one should approach the sealing of such material with caution.

In many circumstances however, the use of sealants over well adhering cementitious type asbestos mixes may be warranted. They are relatively easy to apply, compared to removal in these circumstances, and can prevent or minimize surface erosion of fibers. When loosening of the asbestos from the substrate is no problem, this may be the control measure of choice.

b. Removal of Asbestos

One school in New Jersey with seriously failing fibrous asbestos spray material was selected for the evaluation of the feasibility of removal techniques. As this school was actively negotiating to have asbestos removed from all areas, removal work in selected school rooms as part of this project was compatible with the District's overall objective. Two contractors, each with previous experience in removal of asbestos, were selected to remove the sprayed asbestos from approximately 1,000 square feet in each of two classroom areas and to install a replacement hung ceiling of acoustic panels.

c. Containment Techniques

The work of the contractors was closely supervised and each followed similar general guidelines. It was clear that during the removal of asbestos, two principles must be rigorously followed; the extensive wetting of the asbestos material and the isolation and containment of the work area. The latter was accomplished by extensive use of plastic tarpaulins to enclose the work area, with a double barrier between the removal area and a decontamination area, which in turn was sealed from the rest of the building. Here, workers took showers before passing into other parts of the school.

Because air concentrations within the removal area were expected to be under 10 fiber/ml, half-face mask respirators approved by the National Institute for Occupational Safety and Health for use with asbestos were utilized. (Approved, half-face mask respirators are suitable for use at concentrations below 20 f/ml and disposable, single-use respirators below 10 f/ml. Above 20 f/ml, supplied-air respirators must be utilized.) These provided considerable freedom for the workers and facilitated their work and may, in fact, have aided in maintaining the relatively low asbestos concentrations observed during removal activities. While in the work area, workers wore clothes which were later disposed of as asbestos contaminated material. One contractor supplied workers with nylon suits for use during the entire week of removal operations. These were left within the barrier area at the end of each day and disposed of as contaminated waste at the end of the project. The second contractor supplied workers with disposable paper clothing similar to that of Figure 15, which was disposed of daily or as required.

Prior to removal, the asbestos spray material was extensively wetted with a water mixture containing a solution of 50% polyoxyethylene ester and 50% polyoxyethylene ether (obtainable as a commercial nursery product, Aquagro) which served as a surfactant. The concentration of wetting agent was approximately one ounce per five gallons of water. This was applied as a spray to the ceiling; an electrical pump unit proving to be satisfactory for this purpose. Once the entire ceiling was sprayed with the water amended by surfactant, additional water without surfactant was applied to thoroughly soak the asbestos material. When so wetted the asbestos was readily removed by hand scrapers and allowed to fall to the floor (Figure 18). In one of the removal operations the asbestos mat was totally soaked and occasionally dry spots would be found during removal. These were wetted as found. The incomplete wetting of the asbestos slowed the removal operations but did not increase the measured air concentrations. One classroom had the asbestos sprayed onto a plaster ceiling and its removal was relatively simple. In the other classroom a portion of the asbestos material was sprayed on wire lathe. Following removal of most of the material from the wire surfaces, the lathing was cut down and bagged as contaminated waste. (Figures 19 and 20 show the bagging and disposal of material following its removal from the ceiling.) A 6 mil plastic bag is suitable for this purpose, although two 3 mil plastic bags were utilized in one case. These were sealed, carried from the building, and placed in a dumpster for transport to an approved disposal site. After the asbestos had been bagged, the tarpaulins were removed, disposed of as contaminated waste, the room washed, and a hung ceiling installed (Figure 21).

Table 21 lists the fiber concentrations measured during the various aspects of removal. In in all cases air concentrations were less than 2 fibers/ml. These lower levels were achieved only because of the extensive use of amended water and the continued vigilance on the part of workers to assure that all asbestos was wet during removal. Table 22 lists electron microscopic analysis data showing that no residual asbestos contamination was present in the rooms after completion of the work.

It was evident during this project that previous experience in removal activities was of benefit. One contractor's foreman had considerable experience, came to the job with all requisite equipment, and quickly instructed the workers in its use. Removal work went efficiently with 1000 square feet of asbestos being removed in less than 90 minutes by two workmen following room enclosure. On the other hand, another foreman, apparently inexperienced in asbestos removal, was employed by the other contractor. Here, the initial work went slowly and much instruction had to be offered by Mount Sinai personnel concerning requisite control measures and removal procedures. Once understood, however, the workers soon became proficient and the work proceeded smoothly. This points to the desirability and possible effectiveness of training courses in asbestos removal techniques.

d. Summary of removal operations

In many typical circumstances found in New Jersey schools in which loosely compacted, friable asbestos-containing material are applied to flat, open areas as hallways, classrooms and auditoriums, the removal of asbestos materials can be accomplished efficiently and effectively. Complete wetting of the asbestos, careful enclosure methods and thorough cleanup can minimize contamination from removal operations. Once removed, any concern for future asbestos related problems is eliminated. For many school situations with loosely-bonded asbestos which is flaking from its substrate, it may be the control procedure of choice.

e. Relative Merits of Sealing and Removal

In this project, the removal of loose friable asbestos material succeeded, while the sealing of such material was not completely effective using the sealant chosen in this study. On the other hand, the sealing of cementitious sprayed asbestos went well, while removal of hardened, partially sealed asbestos was difficult. Thus, school administrators might wish to consider removal if the asbestos is loose, poorly compacted, and readily accessable to students, and to look to sealing as more suitable for the compacted material, having good adhesion to a substrate.

Economically, there is relatively little difference in the cost of removing the loose fibrous asbestos and sealing it. Equally rigorous control measures are required as masking and patching activities and high velocity liquid streams may dislodge asbestos material. The basic economic advantage of sealant lies in the absence of a need to replace the removed asbestos, either with a hung ceiling or other acoustic material. Cost considerations, however, tend to favor sealing for cementitious materials. As the asbestos is often well encapsulated and the asbestos matrix has good adherence to the underlying substrate simpler containment procedures may be acceptable, reducing the cost of sealing. Furthermore, the good adherence to the substrate is a disadvantage for removal and increases the cost and difficulty of that procedure. Nevertheless, in spite of economic advantage, one should still consider the consequences of allowing the asbestos to remain in place. It may subsequently be dislodged during maintenance and renovation activities, and during ultimate demolition of the building, containment could be required. Furthermore, one may not have complete assurance that the asbestos matrix will remain locked to the substrate. Water damage and physical abuse could produce dislodgement in the future.

f. Further recommendations

It is clear that the choice of control measures to be applied in a particular school situation is highly judgmental. Each school is unique and the appropriate course of action of an administrator depends on both internal (i.e. local to the school and school district) and external (availability of technology, materials, and procedures, etc.) factors. Furthermore, these factors, particularly the external, are changing rapidly with time. This report has attempted to point to various criteria that could be applied by a school district administrator as he or she considers control procedures for asbestos. Nevertheless, judgments must be made within a limited context including skills and experience of available contractors and the likelihood of adequate containment and cleanup. To assist school administrators in these matters, engineering consultant services might be sought.

There is evidence of clear need for workmen and supervisory personnel to be trained in techniques of sealing and removing asbestos (understanding of health factors, enclosure methods, respiratory protection, work equipment, decontamination procedures, etc.). If training courses are developed, this might well be done in cooperation with unions and contractors. The effectiveness of such training was clearly seen in the relative ease with which asbestos was removed by more experienced personnel.

8. SUMMARY

a. Sprayed asbestos materials have been utilized in a significant proportion of New Jersey public schools.

b. The condition of the sprayed surfaces varies widely; in some instances they are intact and present no current hazard of asbestos contamination. In other cases, the surfaces are damaged or friable, with considerable risk of asbestos contamination of school areas.

c. Asbestos air concentrations vary and correlate well with evidence of physical damage to the asbestos surfaces. In some instances, air concentrations were found at levels which might lead to increased risk of asbestos disease, particularly cancer, in years to come.

d. In general, cementitious asbestos materials were more likely to be intact and to present less risk of asbestos contamination than loosely compacted fibrous materials.

e. The findings suggest that corrective measures are desirable in some New Jersey schools to minimize possible health hazards from asbestos exposure that might exist.

f. The feasibility of two principal approaches to control was studied. An apparently simple method is the covering and sealing of asbestos surfaces by appropriate sprayed sealants. Some qualities of such materials are discussed, and the circumstances in which this technique might suffice are outlined. In other situations, this approach may not be fully satisfactory and in still others it seems dubious of even initial or partial success. There is also the inherent, continuing drawback that the asbestos remains in place with later risk of asbestos exposure during the maintenance, repair, renovation or demolition of the structure.

g. The second procedure was the removal of asbestos surface materials and their replacement with alternate (non-asbestos) materials that would serve the same purposes of acoustic and fire insulation or decorative finish. This approach, however, includes consideration of added initial expense in some instances, and/or added inconvenience in others.

h. For each approach, experiences indicate that care is essential if widespread asbestos contamination of the building and excessive exposure of workmen are to be avoided. Precautions should include proper isolation of the work areas with tarpaulins, protective clothing and respirators, proper bagging and disposal of asbestos wastes and clothes change and showering facilities. When removal of loose, friable material is involved thorough wetting of the surfaces is essential. Too, trained workmen and supervisory personnel are of considerable advantage.

i. The successful control of sprayed asbestos in schools will prevent future exposure of pupils, teachers and administrators, clerical staff, maintenance workmen and custodial personnel.

j. It will be of importance to ascertain whether observations made in this investigation are applicable to problems associated with the presence of sprayed asbestos surface materials in other public buildings, as auditoriums, social halls, YM/WCA's and YM/WHA's, department stores, health care facilities, restaurants and other facilities, as well as in public schools in other states and other countries.

9. ACKNOWLEDGMENTS

The assistance of the New Jersey Department of Education and Environmental Protection was especially useful in this project. Further, it could not have been accomplished without the willing cooperation of the administrators and staffs of many New Jersey school districts.

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REFERENCES

1. Reitze, W.B., Nicholson, W.J., Holaday, D.A. and Selikoff, I.J. Application of sprayed inorganic fiber containing asbestos: occupational health hazards. Am. Indus. Hyg. Assoc. J. 33: 179-191 (1972).

2. Sprayed Insulation Regulations, New York City Department of Air Resources. April, 1970; see also Ref. 1.

3. Nicholson, W.J. Occupational and environmental standards for asbestos and their relation to human disease. Origins of Human Cancer, Cold Spring Harbor Laboratory, 1785-1796 (1977).

4. Environmental Protection Agency, National Emission Standards for Hazardous Air Pollutants, Asbestos, Beryllium, and Mercury. Fed. Reg. 38, 66 (April 6, 1973).

5. Selikoff, I.J., Hammond, E.C. and Seidman, H. Mortality experience of insulation workers in the United States and Canada, 1943-1977. To be published, Ann. N.Y. Acad. Sci. For earlier data see: Selikoff, I.J., Hammond, E.C., and Seidman, H. Cancer risk of insulation workers in the United States. In: Biological Effects of Asbestos, Bogovski, Gilson, Timbrell and Wagner, (eds.) Lyon, IARC, 209-215 (1973).

6. Nicholson, W.J., Selikoff, I.J., Seidman, H. and Hammond, E.C. Mortality experience of asbestos factory workers: effect of differing intensities of asbestos exposure. Environ. Res. (in press). For earlier data, see: Nicholson, W.J. Case study 1: Asbestos--the TLV approach, Ann. N.Y. Acad. Sci. 271: 152-169 (1976).

7. Selikoff, I.J. Lung cancer and mesothelioma during prospective surveillance of 1249 asbestos insulation workers, 1963-1974. Ann. N.Y. Acad. Sci 271: 448-456 (1976).

8. Hammond, E.C., Selikoff, I.J. and Seidman, H. Cigarette smoking and mortality among U.S. asbestos insulation workers. To be published in Ann. N.Y. Acad. Sci. For earlier data see: Hammond, E.C. and Selikoff, I.J. Relation of cigarette smoking to risk of death of asbestos-associated disease among insulation workers in the United States. In: Biological Effects of Asbestos, Bogovski, Gilson, Timbrell and Wagner (eds.) Lyon, IARC, 312-317 (1973).

9. Selikoff, I.J., Hammond, E.C. and Churg, J. Asbestos exposure, smoking and neoplasia. J. Am. Med. Assoc. 204: 106-112 (1968).

10. Harries, P.G. Asbestos hazards in naval dockyards. Ann. Occup. Hyg. 11: 135 (1968).

11. Harries, P.G. et al. Radiological survey of men exposed to asbestos in naval dockyards. Br. J. Ind. Med. 29: 274-279 (1972).

12. McEwen, J., Finlayson, A., Mair, A. and Gibson, A.A.M. Mesothelioma in Scotland, Br. Med. J. 4: 575-578 (1970).

13. Edge, J. Asbestos related disease in Barrow-in-Furness. J. Environ. Res. 11: 244-247, 1976.

14. Wagner, J.C., Sleggs, C.A. and Marchand, P. Diffuse pleural mesothelioma and asbestos exposure in the north western Cape Province. Br. J. Ind. Med. 17: 260-271 (1960).

15. Newhouse, M. , and Thompson, H. Mesothelioma of pleura and peritoneum following exposure to asbestos in the London area. Br. J. Ind. Med. 22: 261-269 (1965).

16. Anderson, H.A. et al. Household contact asbestos neoplastic risk. Ann NY Acad Sci. 271: 311-323 (1976).

17. National Institute for Occupational Safety and Health, U.S.D.H.E.W. Criteria for a recommended standard...occupational exposure to asbestos. HSM 72-10267, pps. VIII-1-8, 1972.

18. Nicholson, W.J., Holaday, D.A. and Heimann, H. Direct and indirect occupational exposure to insualtion dusts in United States shipyards. Safety and Health in Shipbuilding and Ship Repairing, International Labour Office, Geneva (1972), pps. 37-47.

19. United Nations. 1975. Statistical Yearbook 1974, 26th ed. New York.

20. Air Quality Criteria for Particulate Matter. D.H.E.W., (1969) 5-32.

21. Nicholson, W.J. and Pundsack, F.L. Asbestos in the environment. Biological Effects of Asbestos, Lyon, International Agency for Research on Cancer, (1973), 126-130.

22. Environmental Sciences Laboratory data entered, U.S. District Court for Minnesota, 1973, U.S. vs. Reserve Mining Company, No. 5-72-Civil-19, Sept. 6, 1973.

23. Nicholson, W.J. Measurement of asbestos in ambient air, Final Report, Contract CPA 70-92, National Air Pollution Control Administration (1971).

24. Beaman, D.R. and File, D.M. Quantitative determination of asbestos fiber concentrations. Anal. Chem 48(1): 101-110 (1976).

25. Anderson, C.H. and Long, J.M. Preliminary interim procedure for fibrous asbestos, U.S.E.P.A. Analytical Chemistry Branch, July 31, 1976.

26. Office of Technical Analysis, U.S.E.P.A. A preliminary report on asbestos in the Duluth, Minnesota, area. January, 1974, 33.

27. Sebastien, P., Gaudichet, A., Dufour, G., Bonnaud, G., Bignon, J. and Goni, J. Enquete metrologique sur la pollution atmospherique interieure des batiments isoles par projection d'amiante (1977).

28. Nicholson, W.J., Rohl, A.N. and Ferrand, E.F. Asbestos air pollution in New York City. In Proceedings of the Second Clean Air Congress, (eds.) England, H.M. and Barry, W.T., Academic Press, New York, (1971) 136-139.

29. Nicholson, W.J., Rohl, A. and Weisman, I. Asbestos contamination of the air in public buildings, Final Report, Contract No. 68-02-1346, Environmental Protection Agency (1975). See also, Nicholson, W.J., Rohl, A.N. and Weisman, I. Asbestos contamination of building air supply systems. Proc. Int. Conf. on Environmental Sensing and Assessment: Vol II., Paper 29-6, Inst. Electrical and Electronic Engineers (1976).

30. Environmental Sciences Laboratory data, to be published.

31. Wagoner, Joseph K. Occupational Safety and Health Administration, U.S. Department of Labor, personal communication.

32. Brown, H.V. UCLA, Los Angeles, California. Personal communication to R.N. Sawyer.

33. Sawyer, R.N. Asbestos exposure in a Yale building: analysis and resolution. Environ. Res. 13: 1, 146-168 (1977).

34. Peterson, Irving M. New Jersey Department of Education, personal communication.

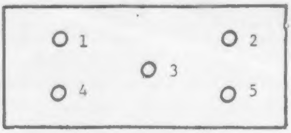
35. Environmental Sciences Laboratory data.

Appendix 1

ELECTRON MICROSCOPIC ANALYSIS OF AIR SAMPLES FOR CHRYSOTILE ASBESTOS

Samples for electron microscopic analysis were collected on membrane filters having a nominal pore size of 0.8 mm. While the effective pore size of these filters is larger than the diameter of many of the asbestos fibers of interest, it has been shown that the surface charge properties of the filter and of the asbestos fibers, as well as the circuitous path through the filter, allow virtually complete collection of all asbestos material.

To prepare a sample for analysis in the electron microscope, a portion of the sample, mounted on a microscope slide, was ashed in a low-temperature activated oxygen asher for one to four hours. This served to remove the membrane filter material, all organic material in the collected sample, soot and other carbonaceous material. The residue, consisting mostly of fly ash and mineral matter, was dispersed on the microscope slide by grinding the sample with a watch glass in a solution of 1% nitrocellulose in amyl acetate for 5 to 10 minutes. The sample was dispersed uniformly over two microscope slides by placing another glass microscope slide over the ground sample, and drawing the microscope slides apart. Upon evaporation of the amyl acetate, the dispersal was scanned for uniformity visually or by light microscopy. The two films were floated onto water and five electron microscope grids placed on each in the following pattern:



Grids 1, 3 and 5 would be selected from each film and one square from each scanned at 20,000 times magnification. All chrysotile asbestos fibers, identified on the basis of their unique tubular morphology, were sized, and their mass determined. Using the known air volumes and dilution factors appropriate to the above technique, the mass concentrations were calculated. A correction for an average loss of 40% during processing was applied. This value has been obtained from the results of previous measurements which indicate losses range from 33% to occasionally more than 50%.

Data from replicate analysis of samples indicate that a given value is accurate within a factor of two for concentrations greater than 10 ng/m^3 and sampling times of three or more hours with high volume samplers. Greater variability exists for shorter sampling times or lower asbestos concentrations due to the greater relative importance of background contamination of the fibers and that occurring during sample processing.

Appendix 2

ANALYSIS OF INSULATION MATERIALS OBTAINED FROM NEW JERSEY SCHOOLS

A. Optical Microscopic Analysis:

A Leitz Ortholux microscope equipped with bright field illumination and polarized light optics was used to analyze the samples. Optical properties such as refractive indices, extinction angles of fibers, relief and bi-refringence were measured. These optical constants, in combination with general morphology, were used for identification of the mineral phases present. With few exceptions, all particles were within the working resolution capabilites of the microscope and could be identified.

Estimates of the quantities of asbestos minerals present in the insulation samples were made by comparison with binary dilution standards of five asbestos minerals in rock wool matrices, mounted on microscopic slides.

B. X-ray Diffraction Analysis:

For identification and quantification the asbestos content of insulation samples, a Phillips x-ray diffractometer equipped with high-intensity copper x-ray tube, a curved crystal focusing monochrometer, a pulse-height analyzer, scintillation counter detector and wide range gonianetes were used.

In order to study the presence of all crystaline components, the samples -- after being pulverized to obtain an effective crystallite dimension on the order of 5 mm or less -- were scanned from 5½ to 70½ 2 theta at a scanning rate of 1½ 2 theta per minute. This technique proved satisfactory for the identification of major components, including all asbestos minerals present in amounts greater than about 3% by weight.

Table 1

Deaths among 17,800 asbestos insulation workers
in the United States and Canada
January 1, 1967 - December 31, 1976

Number of men	17,800
Man-years of observation	166,855

	Expected	Observed	Ratio
Total deaths, all causes	1,660.96	2,270	1.37
Total cancer, all sites	319.90	994	3.11
Lung cancer	105.97	485	4.58
Pleural mesothelioma	**	66	--
Peritoneal mesothelioma	**	109	--
Cancer of esophagus	7.01	18	2.57
Cancer of stomach	14.23	22	1.55
Cancer of colon-rectum	37.86	59	1.56
All other cancer	154.83	235	1.52
Asbestosis	**	162	--
All other causes	1,351.06	1,114	0.82

* Expected deaths are based upon white male age specific mortality data of the U.S. National Center for Health Statistics for 1967-1975 and extrapolation to 1976.

** These are rare causes of death in the general population.

From: Selikoff, I.J., Hammond, E.C. and Seidman, H. Mortality experience of insulation workers in the United States and Canada, 1943-1977. To be published, Ann. N.Y. Acad. Sci.

Table 2

Expected and observed deaths among 689 factory workers, employed before January 1, 1939, during the seventeen years from January 1, 1959 through December 31, 1975.

	1959 - 1975		
	Obs.	Exp.	Obs./Exp.
All causes	274	188.19	1.46
Cancer, all sites	99	39.92	2.47
Lung cancer	35	12.53	3.91[a]
Pleural mesothelioma	14	n.a.	--
Peritoneal mesothelioma	12	n.a.	--
Cancer of esophagus stomach, colon and rectum	15	7.99	1.88
Cancer all other sites	23	19.40	1.19
All respiratory disease	42	12.16	3.45
Asbestosis	35	n.a.	--
Other respiratory	7	(b)	--
All other causes	133	136.11	0.98
Person-years of observation		9,646	

a) Pleural mesothelioma included with cancer of bronchus in calculating ratio since expected rates are based upon "cancer of lung, pleura, bronchus, trachea."

b) This rate is virtually identical with that of "all respiratory disease."

n.a. = not available.

From: Nicholson, W.J. Case Study 1: Asbestos--the TLV approach. Ann NY Acad. Sci. 271: 152-169, 1976.

Table 3

Deaths of lung cancer among asbestos insulation workers in the United States and Canada, 1967-1976; Influence of cigarette smoking

	Observed deaths	Expected deaths*	
		U.S.**	Smoking specific**
1. History of Cigarette smoking	325	60.07	66.78
Current smokers	228	31.87	39.69
Ex smokers	97	23.29	13.34
2. No history of cigarette smoking	8	14.11	1.82
Never smoked	5	8.49	0.98
Pipe/Cigar	3	5.63	0.84
3. Unknown history of cigarette smoking	152	31.80	11.93
Total	485	105.97	66.78

* Age, year and sex specific.

** Based upon age apecific data of the U.S. National Center for Health Statistics, cigarette smoking not considered.

*** Based upon American Cancer Society's Cancer Prevention Study, 1967-1972.

From: Hammond, E.C., Selikoff, I.J. and Seidman, H. Cigarette smoking and mortality among U.S. asbestos insulation workers. To be published in Ann. NY Acad. Sci.

Table 4

Distribution of 24 hour chrysotile asbestos concentrations in the ambient air of U.S. cities

Electron Microscopic Analysis

Asbestos Concentration (ng/m^3) Less Than	Mount Sinai School of Medicine		Battelle Memorial Institute	
	Number of Samples	Percentage of Samples	Number of Samples	Percentage of Samples
1.0	61	32.6	27	21.3
2.0	119	63.6	60	47.2
5.0	164	87.7	102	80.1
10.0	176	94.2	124	97.6
20.0	184	98.5	125	98.5
50.0	185	99.0	127	100.0
100.0	187	100.0	127	100.0

For these 24 hour samples, which by their length averages out possible peak periods during the day 98.5% had chrysotile asbestos concentrations less than 20 ng/m^3.

From: Nicholson, W.J. Measurement of asbestos in ambient air, Final Report, Contract CPA 70-92, National Air Pollution Control Administration (1971). And: Office of Technical Analysis, U.S. E.P.A. A preliminary report on asbestos in the Duluth, Minnesota, area. January, 1974, 33.

Table 5

Chrysotile content of ambient air in
New York City by borough
(6 - 8 hour daytime samples)

Sampling locations	Number of samples	Asbestos air level in 10^{-9} g/m^3 (ng/m^3) Range	Asbestos air level in 10^{-9} g/m^3 (ng/m^3) Average
Manhattan	7	8-65	30
Brooklyn	3	6-39	19
Bronx	4	2-25	12
Queens	4	3-18	9
Staten Island	4	5-14	8

Nicholson, W.J., Rohl, A.N. and Ferrand, E.F. Asbestos air pollution in New York City. In, Proceedings of Clean Air Congress, (eds.) England, H.M. and Barry, W.T., Academic Press, New York (1971) 136-139.

Table 6

Chrysotile air levels near spray fireproofing sites
(6 - 8 hour daytime samples)

Sampling locations	Number of samples	Asbestos air level 10^{-9} g/m^3 (ng/m^3) Range	Asbestos air level 10^{-9} g/m^3 (ng/m^3) Average
1/8 - 1/4 mile	11	9 - 375	60
1/4 - 1/2 mile	6	8 - 54	25
1/2 - 1 mile	5	3.5- 36	18

(The above concentrations reflect both downwind and upwind sampling locations.)

From: Nicholson, W.J., Rohl, A.M. and Ferrand, E.F. Asbestos air pollution in New York City. In, Proceedings of Clean Air Congress, (eds.) England, H.M. and Barry, W.T., Academic Press, New York (1971), 136-139.

Table 7

Chrysotile concentrations in the air of buildings according to type of asbestos spray (6 - 8 hour daytime samples)

Chrysotile concentrations (ng/m^3) in:

	Building air			Outside air		
Building	No of. samples	Mean concentration	Range	No of. samples	Mean concentration	Range
			Cementitious Spray			
A	3	68	11-180	1	46	46
B	3	12	2.6-17	1	18	18
C	3	7.0	2.6-11	1	5.0	5.0
D	4	4.8	1.2-10	2	5.0	0.3-9.8
E	2	9.4	0.9-18	1	24	24
F	2	12	1.4-23	2	9.2	3.4-15
			Fibrous Spray			
A	3	8.8	0-25	1	3.9	3.9
B	9	2.6	0-55	3	8.0	0-11
C	6	29	0.6-56	2	9.1	3.3-15
D	4	39	6.6-97	2	12	9.3-14
E	6	200	12-830	-	--	--
F	5	11	6.4-14	2	14	10-19
			Acoustical and Decorative Spray			
A	3	2.1	0-3.7	1	4.3	4.3
B	4	8.1	0.7-17	2	18	3.5-32
C	6	41	3.7-160	2	48	9.9-87
D	6	17	2.7-57			
E	6	28	0.9-110			
			No Asbestos in Building			
A	3	7.2	2.3-12	1	0	0
B	6	9.2	0-42	2	2.0	1.4-2.7

From: Nicholson, W.J., Rohl, A. and Weisman, I. Asbestos contamination of the air in public buildings, Final Report, Contract No. 68-02-1346, Environmental Protection Agency (1975).

Table 8

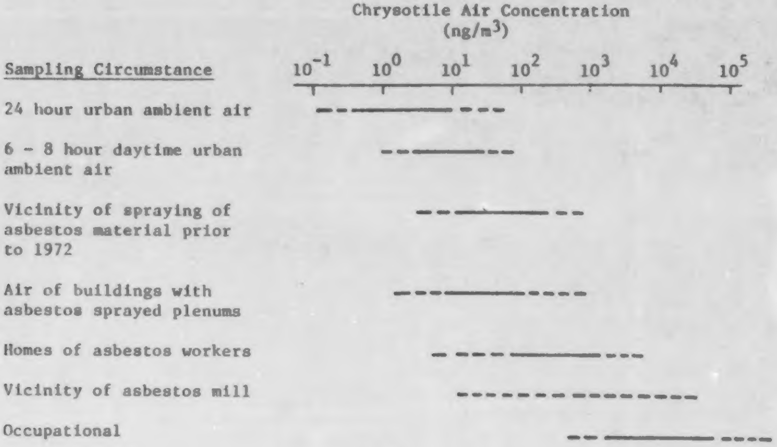
Distribution of chrysotile asbestos concentrations in the ambient air of Paris, France

Asbestos Concentrations (ng/m3) Less Than	Number of Samples	Percentage of Samples
1.0	16	68.4
2.0	3	84.2
5.0	0	84.2
10.0	3	100.0

From: Sebastien, P., Gaudichet, A., Dufour, G., Bonnaud, G., Bignon, J. and Goni, J. Enquete metroligique sur la pollution atmospherique interieure des batiments isoles par projection d'amiante (1977).

Table 9

Environmental air concentrations of chrysotile asbestos



From published and unpublished Environmental Sciences Laboratory data (see text).

Table 10

Sprayed asbestos in New Jersey schools

		Square feet				Square feet	
District	No. of schools	Visible flaking reported	No flaking reported	District	No. of schools	Visible flaking reported	flaking reported
1	1		18,188	51	1		2,354
2	1		15,155	52	1		5,235
3	1		2,500	53	1		2,750
4	3	8,878	16,804	54	1		42,000
5	1		1,988	55	1		7,580
6	1		14,088	56	1		51,085
7	1	630		57	2		9,241
8	1		2,342	58	1		1,200
9	1	3,577	54,585	59	1		1,296
10	3		38,770	60	1		500
11	1		2,400	61	1		45,279
12	3		30,085	62	1		50,000
13	1		1,500	63	1		49,695
14	1		3,428	64	2	1,360	
15	4		21,200	65	1		11,008
16	1		7,200	66	2	50	700
17	1		2,606	67	1		46,000
18	2		9,444	68	1		30,000
19	2		10,300	69	4		26,100
20	1		5,131	70	1		5,875
21	1		11,000	71	6		14,082
22	1		40,000	72	5	35,000	22,500
23	3		134,000	73	1		4,000
24	1		9,900	74	1		2,000
25	1		33,330	75	1	7,180	
26	1		10,000	76	4		13,747
27	4		51,065	77	1	1,701	13,681
28	1		3,100	78	4	8,470	3,955
29	1		4,800	79	1	1,574	
30	1		4,250	80	6		17,550
31	3		145,400	81	8		162,471
32	3		2,100	82	1		6,000
33	1		8,000	83	2		3,000
34	1		2,728	84	5		4,077
35	1		61,337	85	1	300	16,500
36	2		22,500	86	3		5,370
37	1		9,000	87	1		38,380
38	5		405,460	88	1		440
39	1		8,570	89	1		5,000
40	2	1,953	9,726	90	2		1,972
41	4		2,486	91	1		1,120
42	3		11,285	92	1		6,568
43	1		802	93	2		1,970
44	1		1,344	94	1		45,000
45	1		56,229	95	3	1,950	14,290
46	12		40,000	96	2	1,952	14,653
47	1		1,892	97	2		21,751
48	1		1,180	98	1	3,378	
49	3	2,560	1,280	99	1		420
50	1		600	100	2		10,000

(continued)

Table 10 (continued)

District	No. of schools	Square feet Visible flaking reported	No flaking reported
101	1		4,500
102	1		5,362
103	1		1,090
104	1		1,640
105	3		16,100
106	1		48,320
107	1		7,913
108	1		12,537
109	1		7,811
110	1		42,336
111	1		2,082
112	1		3,500
113	2	2,000	19,582
114	2	7,700	1,200
115	4	19,251	20,045
116	1		1,800
117	1		1,070
118	8		8,800
119	4	112	43,727
120	1		1,600
121	1		10,399
122	2	1,333	133,700
123	2		28,709
124	3		20,700
125	1		27,488
126	2		5,739
127	1	1,966	30,000
128	1		1,386
129	1		583
130	3		9,189
131	1		100
132	1		1,385
133	1	23,237	
134	1		450
135	1	6,000	2,000
136	1		1,500
137	3		17,704
138	1		1,000
139	1		150
140	1	5,659	780
141	1		4,320
142	1		15,380

Table 11
Results of petrographic microscopic and x-ray diffraction analyses of ceiling insulation materials from New Jersey schools

District School	Location	Chrysotile asbestos (%)	Amosite asbestos (%)	Crocidolite asbestos (%)	Tremolite or Anthophyllite asbestos (%)	Other fiber content	Other non-fibrous minerals
District 19, School 1	boiler room	10-15	—	—	—	Rock wool	—
1	mech. drawing room	1-3	—	—	—	—	Plaster
[illegible]	classroom	5-7	—	—	—	—	Plaster
2	student area	8-10	—	—	—	—	Vermiculite
District 20, School 1	hallway	8-10	3-6	—	—	—	Vermiculite
1	boys locker room	5-6	—	—	—	—	Vermiculite, calcite, plaster
District 17, School 1	storage area	3-5	10-15	15-20	—	Rock wool	---
1	boiler room	1-2	—	—	—	Rock wool	---
2	boiler room	—	20-25	20-25	—	Rock wool	---
District 48, School 1	class room	3-5	—	—	10-15	—	Talc, quartz, perlite
District 113, School 1	industrial arts area	12-15	—	—	—	Rock wool	Plaster
2	hallway	12-15	—	—	—	—	Cellulose
District 114, School 1	boiler room	8-12	—	—	—	Rock wool	—
District 61, School 1	industrial arts	4-7	—	—	—	—	Vermiculite, plaster
District 9, School 1	first floor corridor	8-12	—	—	—	Rock wool	Plaster
District 115, School 1	boiler room	—	45-50	—	—	Rock wool	—
District 78, School 1	cafeteria	7-10	—	—	—	Rock wool	—
2	boiler room	—	45-50	—	—	Rock wool	—
3	boiler room	8-12	—	—	5-8	Rock wool	Vermiculite, talc
4	custodian's office	5-10	35-40	—	—	Rock wool	—
District 15, School 3	classroom	1-2	—	—	—	—	Cellulose, plaster
District 69, School 1	swimming pool	20-30	—	—	—	—	Plaster, quartz
2	swimming pool	—	—	—	—	Rock wool	---
3	classroom	2-5	—	—	—	—	Perlite, vermiculite, plaster
District 31, School 1	hallway to auditorium	2-5	—	—	—	—	Plaster, cellulose
1	auditorium	2-5	—	—	—	—	Plaster, cellulose
2	lobby	2-5	—	—	—	—	Plaster
2	auditorium	2-5	—	—	—	—	Cellulose, clay
3	principal's office	5-8	—	—	2-3	—	Vermiculite, talc
3	hallway (new wing)	5-8	—	—	8-10	—	Vermiculite, talc
District 23, School 1	classroom	8-12	—	—	2-3	—	Vermiculite, talc
2	classroom	6-8	—	—	5-7	—	Vermiculite, talc
3	auditorium	6-8	—	—	2-4	—	Vermiculite, talc
1	classroom	6-8	18-22	—	5-7	—	Vermiculite, talc
District 27, School 1	hallway (new wing)	10-20	—	—	2-4	—	Vermiculite, talc
1	hallway (old wing)	5-8	—	—	6-8	—	Vermiculite, talc
2	classroom	5-8	—	—	4-6	—	Vermiculite, talc
2	classroom	5-8	—	—	3-6	—	Vermiculite, talc
District 124, School 1	custodian's work area	2-4	—	—	—	—	Plaster, perlite, cellulose
1	shop area	2-4	—	—	—	—	Plaster, perlite
2	administration office	5-8	—	—	0.5-1	—	Cellulose, talc, perlite
3	classroom	8-12	—	—	2-4	—	Vermiculite, tacl
District 14, School 1	cafeteria	3-5	—	—	—	—	Plaster
1	classroom	5-8	—	—	3-6	—	Vermiculite, talc
District 18, School 1	hallway	1-3	—	—	—	—	Cellulose, plaster
2	office	7-10	—	—	8-10	—	Vermiculite, talc
3	auditorium	5-7	—	—	—	—	Plaster, cellulose
4	classroom	5-10	—	—	—	—	Plaster
District 17, School 1	classroom	5-10	—	—	—	—	Perlite
District 110, School 1	classroom	8-12	—	—	—	Rock wool	Plaster
District 41, School 1	auditorium	5-8	—	—	—	--	Plaster
1	boy's locker room	30-40	--	--	--	--	Plaster
2	classroom	30-40	--	--	--	Rock wool	Plaster
3	classroom	--	--	--	--	--	Cellulose, plaster
4	classroom	1-2	--	--	--	--	Perlite
District [illegible], School 1	boiler room	12-15	--	--	--	Rock wool	Plaster
2	classroom	5-12	--	--	0.5-1	--	Vermiculite, talc, perlite
2	boiler room	8-12	--	--	—	Rock wool	Plaster, cellulose
3	multipurpose room	8-12	--	--	--	Rock wool	Plaster
3	custodian's room	3-5	--	--	—	Rock wool	Plaster
4	mechanical room	8-12	--	--	--	Rock wool	Plaster
4	boy's locker room	8-12	--	--	--	Rock wool	Plaster
	gymnasium	5-8	--	--	--	Rock wool	Plaster
	hallway	--	--	--	--	--	Cellulose

Table Q2

Condition of Asbestos Material in New Jersey Schools

District/School	Type of Asbestos Containing Material: Loose, friable fibrous asbestos spray material	Type of Asbestos Containing Material: Moderately dense asbestos spray material often in association with vermiculite or perlite	Type of Asbestos Containing Material: Plaster or textured paint material with asbestos binder	
District 15, School 1	1			
1			0	
1			0	
2		1		
District 20 School 1		3		
1		3		
District 57 School 1	1			
1	1			
2	1			
District 48, School 1		1		
District 115, School 1	3			
2	2			
District 114, School 1	1			
District 61, School 1		0		
District 9, School 1	3			
District 135, School 1	0			
District 78, School 1	2			
2	1			
3			0	
4			1	
District 15, School 3			0	
District 69, School 1		2		
2	1			
3		1		
District 31, School 1		1		
1		1		
2			2	
2		1		
3		1		
3		2		
District 23, School 1		1		
2		0		
3		1		
3		1		
District 27, School 1		0		
1		1		
2		0		
2		0		
District 124, School 1	2			
1		2		
2		0		
3		0		
District 54, School 1		0		
1		0		
District 38, School 1		1		
2		0		
3		0		
4		0		
District 37, School 1		0		
District 110, School 1		0		
District 81, School 1		2		
1		3		
2		0		
3	0			
4		1		
District 72, School 1	0			
2		3		
2	3			
3	2			
3	1			
4	0			
4	1			
5	2			
6	1			
No. damaged/No. visited	18/22	21/36	2/6	41/64

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0 = intact, good condition
1 = minimum damage, no significant deterioration
2 = moderate localized damage or deterioration
3 = significant damage and deterioration

Table 13

Chrysotile asbestos air concentrations in New Jersey schools electron microscopic analysis

School & District	Sample Location	Condition of Asbestos Material	Sampling Time (min)	Asbestos Concentration (ng/m^3)
District 9, School 1 (loose, fibrous spray)	Hallway	Damaged	69	320
	Girls Locker Room	Flaking	103	80
	Cafeteria	Intact	176	53
District 20, School 1 (cementitious)	Girls Locker Room	Slightly damaged	263	43
	Hallway	Damaged	173	280
	Outside Parking Area		110	3
	Physical Ed. Office	Intact	180	26
District 115, School 2 (fibrous spray)	Sweeping of Hallway	Slightly water damaged	10	1,950
	Dry mopping of hallway	Slightly water damaged	10	230

With the exception of the first sample, no asbestos was visible on floors during sampling procedures.

Table 14

Airborne asbestos fiber concentrations
Yale Art and Architecture building, 1974
optical microscopic analysis

Sampling Conditions	Counts	(Fibers/cc)	
or Situation	Mean	N	SD
City Background			
New Haven	0.00	10	0.00
Building Background Fallout			
Quiet conditions	0.02	13	0.02
Impact			
Cleaning, moving books in stack area	15.54	3	6.74
Relamping light fixtures	1.38	2	0.13
Dispersal			
General activity:			
random areas	0.19	10	0.26
students	0.02	15	0.03
administration	0.04	11	0.04
food service	0.09	4	0.06
library staff	0.32	6	0.33
Custodial service:			
sweeping, dry	1.63	5	0.73
dusting, dry	4.02	6	1.28
proximal to cleaning	0.26	6	0.26
Simulated Work Activities			
Electricians: installing single section of track	7.70	6	2.89
Electricians: replacement of single light unit.	1.10	5	0.97
Carpenters: installing single 4 ft. partition	3.14	4	1.10
Mechanics: removal of 1 x 2 ft. ceiling section	17.05	3	8.16

From: Sawyer, R.N. Asbestos exposure in a Yale building: analysis and resolution. Environ. Res. 13: I, 146-168 (1977).

Table 15

Chrysotile asbestos air concentrations in New York and Massachusetts schools

Sampling Location	Sampling Time (min)	Asbestos Concentration (ng/m^3)
Massachusetts school		
Corridor with sprayed-on, painted asbestos high and unreachable.	360	47
Library with sprayed-on painted asbestos high and unreachable.	376	38
Store room--recent duct work installed in asbestos sprayed area.	362	240
Corridor with hung ceiling above which is sprayed-on asbestos; panels are occasionally disturbed.	390	170
Stage with asbestos sprayed-on steel beams; recent construction activity.	334	260
New York schools		
Hallway sprayed with friable asbestos containing plaster.	190	54, 108, 135 (3 samples)
Swimming pool sprayed with fibrous asbestos.	180	9
Music room sprayed with fibrous asbestos--visible damage.	180	80

From: Environmental Sciences Laboratory data.

Table 16

Distribution of asbestos* concentrations in the ambient air of school building rooms in Paris, France

Asbestos Concentrations (ng/m^3) Less Than	Number of Samples	Percentage of Samples
1	5	10.4
2	7	25.0
5	13	52.1
10	6	64.6
20	4	73.0
50	6	85.4
100		85.4
200	1	91.7
500	3	93.7
1000	3	100.0

* Eight samples had measureable amounts of amphibole asbestos are the values listed include both chrysotile and amphibole concentration. Of the seven values above 100 ng/m^3, only one has an amphibole contribution.

From: Sebastien, P., Gaudichet, A., Dufour, G., Bonnaud, G. Bignon, J. and Goni, J. Enquete metroligique sur la pollution atmospherique interieure des batiments isoles par projection d'amiante (1977).

Table 17

Fiber concentrations during "abuse" of asbestos materials in school hallways

Sample Number	Activity	Sampling time (min)	Sampling rate (l/min)	Fiber concentration (f/ml)
	District 9, School 1			
1	Brushing of friable asbestos material on ceiling with hand to simulate damage displayed in Fig. 3. (Area sample 3 feet above floor, ten feet from activity.)	15	10	3.8
2	Same as above (ten feet from activity, 20 feet from Sample 1)	15	10	2.9
3	Personal sample during "abuse" activity	5	2	0.34
	District 20, School 1			
4	Brushing of cementitious material on ceiling with hand to simulate damage displayed in Fig. 3. (Area sample 3 feet above floor, ten feet from activity.)	10	10	0.2
5	Same as above (ten feet from activity, 20 feet from Sample 4)	10	10	0.0
6	Personal sample during "abuse" activity	2	5	0.0

Table 18

Fiber concentrations during sealing of asbestos materials in schools

Sample Number	Activity	Sampling time (min)	Sampling rate (l/min)	Fiber concentration (f/ml)
	District 72, School 3			
1	Enclosure of light fixture with plastic (personal sampler)	30	2	0.0
2	Hanging of plastic tarpaulins (Personal sampler)	30	2	0.8
3	In work area during spraying of sealant on ceiling; sampler on scaffolding	30	10	0.1
4	Spraying sealant on ceiling (personal sampler)	30	2	0.5
5	Hallway outside work area during spraying	30	10	0.05
6	Hallway outside work area immediately after completion of spraying	30	10	0.04
	District 20, School 1			
7	Masking of fixtures in locker room	20	2	0.0
8	Outside work areas during spraying of sealant	30	10	0.0

No sample could be taken in spray area because of clogging of filters by sealants.

7

Table 19

Chrysotile asbestos concentrations after sealing of asbestos material

Electron microscopic analysis

Sampling Circumstance	Sampling Time (min)	Asbestos Concentrations (ng/m^3)
Sampling one month after completion of work		
District 20, School 1		
On stairwell to locker room	180	340
Middle of hallway	180	80
Sampling four months after completion of work		
District 20, School 1		
On stairwell to locker room	90	0
Locker room	90	50

Table 20

Chrysotile asbestos concentrations after sealing or removal of asbestos material

Electron microscopic analysis

Sampling Circumstance	Sampling Time (min)	Asbestos Concentrations (ng/m^3)
District 72, School 3		
Sampling two days after completion of work		
Multipurpose room A air after sealing of damaged friable asbestos material	35	65
Multipurpose room B air after sealing of damaged friable asbestos material	34	0
Sampling one month after completion of work		
Multipurpose room A	165	11
Multipurpose room B	165	8
Sampling one month after removal of asbestos		
Multipurpose room A after removal of previously sealed asbestos material	90	0
Multipurpose room B after removal of previously sealed asbestos material	90	90

Table 21

Asbestos fiber concentrations during removal of asbestos spray materials

Sample number	Activity	Sampling time (min)	Sampling rate (l/min)	Fiber concentration (f/ml)
	Contractor A			
1-A	Hallway outside work area (barrier in place) during application of amended material.	41	10	0.03
2-A	Worker applying amended water to dry ceiling material	10	2	0.05
3-A	Stationary sample in work area during wetting of ceiling material with amended water	28	2	0.02
4-A	Hallway outside work area (barrier in place) during removal of ceiling material.	56	2	0.02
5-A	Workers removing ceiling material after wetting.	20	2	0.05
6-A	Stationary sample in work area during ceiling material removal.	40	10	0.37
7-A	Hallway outside of work area (barrier in place) during removal of ceiling material.	63	2	0.01
8-A	Stationary sample in work area during removal of ceiling material.	45	10	1.05
9-A	Worker removing ceiling material.	22	2	0.23
10-A	Stationary sample outside of hallway barrier during gross clean-up in work area.	81	2	0.03
11-A	Stationary sample in work area during cleaning of ceiling and removal of wire mesh.	13	10	1.23
12-A	Personal sample in work area shoveling bulk material into bags.	14	2	0.15
13-A	Stationary sample in work area during shoveling of bulk material into plastic bags.	13	10	1.78

(continued)

Table 21 (continued)

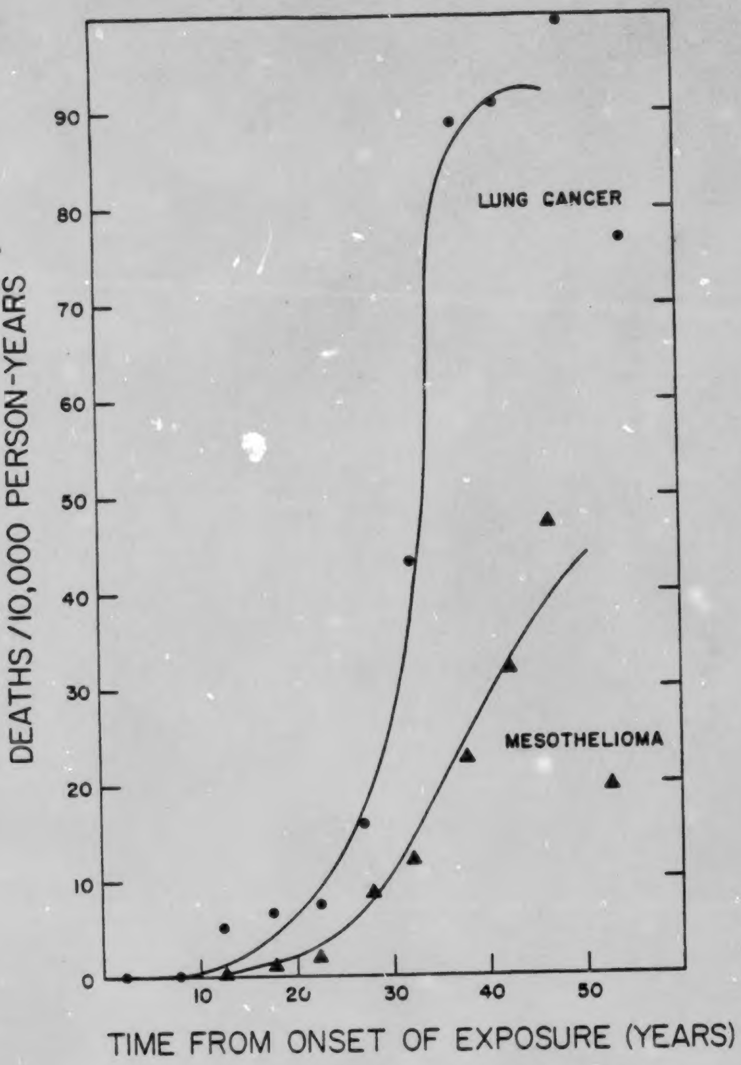
Sample number	Activity	Sampling time (min.)	Sampling rate (1/min)	Fiber concentration (f/ml)
14-A	Stationary sample - middle area - during second bagging of bulk material.	24	2	0.02
15-A	Stationary sample in school hall on exit routs (work area to dumpster) during transfer of bags of dumpster.	29	10	0.02
16-A	Personal sample on worker as he carried bags of material to dumpster.	16	2	0.11
	Contractor B			
1-B	Stationary sample in work area during wetting of dry ceiling material with amended water.	27	10	0.39
2-B	In middle area (barriers in place) during application of amended water.	37	2	0.008
3-B	In middle area during removal of wet ceiling material in work area.	48	2	0.03
4-B	In work area on worker-body monitor during removal of ceiling material.	15	2	0.03
5-B	Stationary sample in work area during removal of "wet" material.	21	10	0.55

Table 22

Chrysotile asbestos concentrations after removal of asbestos material

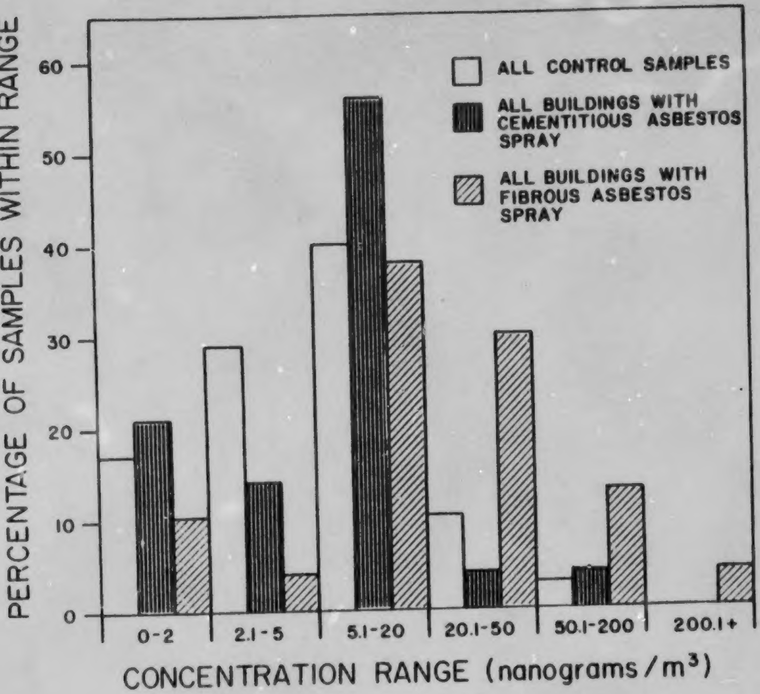
Electron microscopic analysis

Sampling Circumstance	Sampling Time (min)	Asbestos Concentrations (ng/m^3)
Sampling two days after completion of work		
District 9, School 1		
Classroom A after removal of fibrous asbestos material	37	5
Classroom B after removal of fibrous asbestos material	36	14



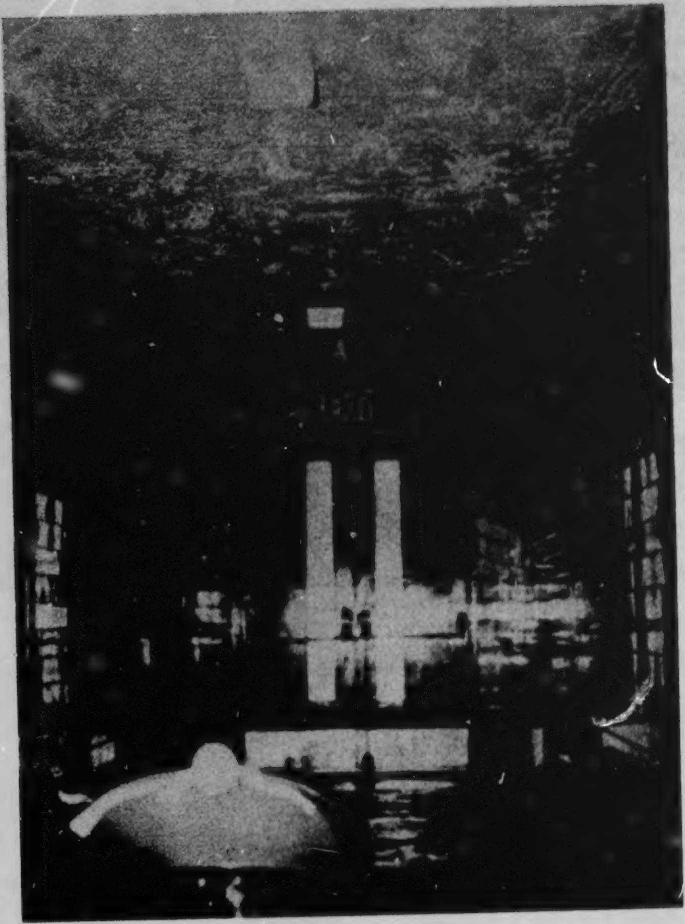
The excess, asbestos-related mortality rates for lung cancer and mesothelioma according to time from onset of asbestos disease.

Figure 1



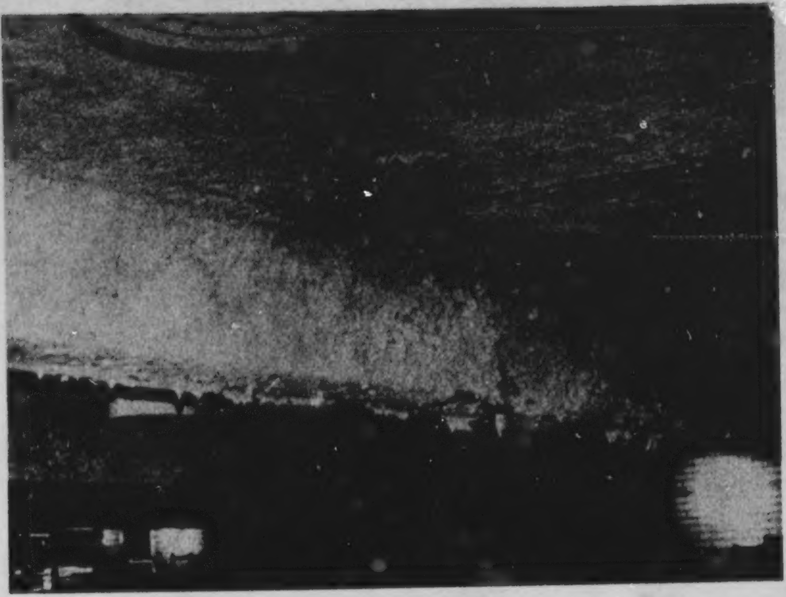
The percentage of asbestos air concentrations within a given range for buildings in which loosely-bonded, fibrous asbestos spray, cementitious asbestos spray, or no asbestos material was used for fireproofing or acoustical purposes.

Figure 2



Damage to asbestos materials sprayed on a hallway ceiling. This was easily reached by students and extensive damage was present throughout the length of the hallway.

Figure 3



Disintegration of fibrous spray material in a building storage area. The conditions seen occurred spontaneously, with no evidence of external abuse.

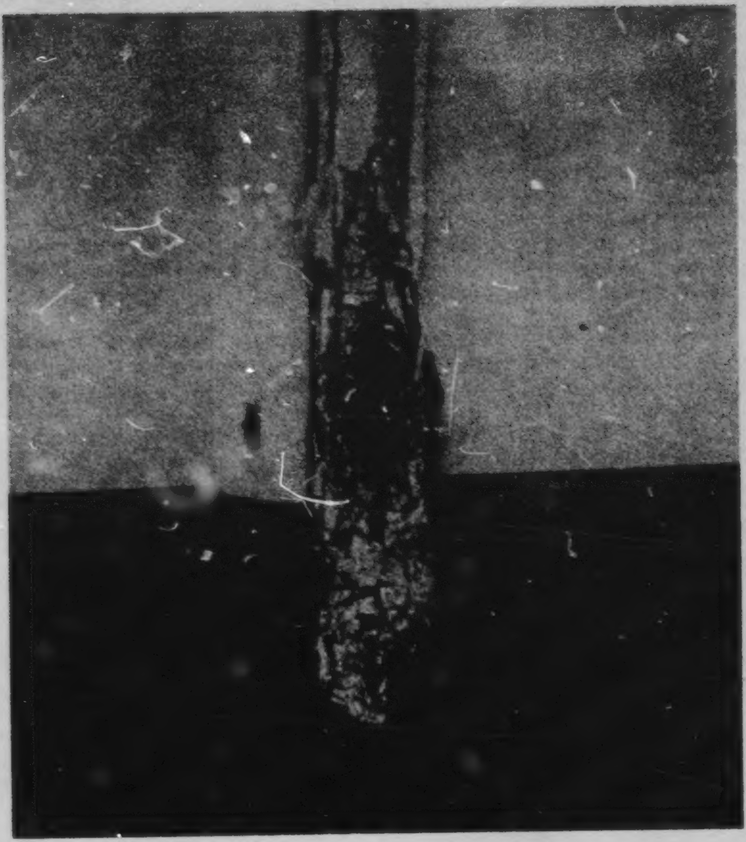
Figure 4

Damage to cementitious asbestos spray in a school hallway. Some of the indentations occurred from flagpoles inadvertently striking the ceiling during color guard practices.

Figure 5

Further damage to cementitious ceiling material. Here evidence exists that some students wished to be remembered beyond their stay at the school.

Figure 6



Exposed asbestos thermal insulation material around a pipe in a school classroom. Such material can also present an exposure risk to students.

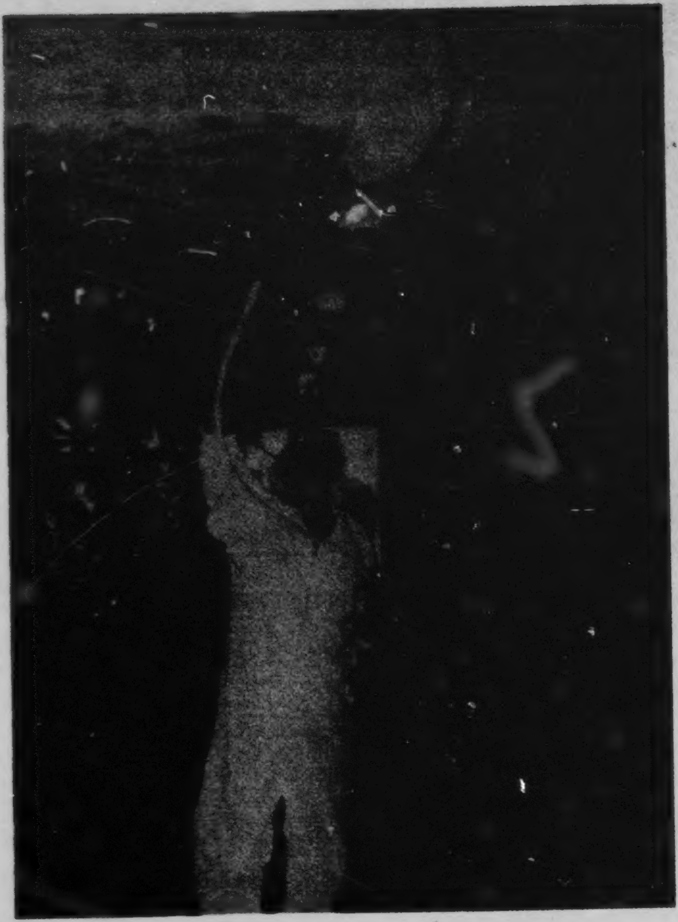
Figure 7

Complete enclosure of locker area prior to spraying a sealant over cementitious asbestos material on ceiling.

Figure 8

All damaged ceiling material was patched with spackle prior to application of a sealant in order to obtain a smooth final surface.

Figure 9



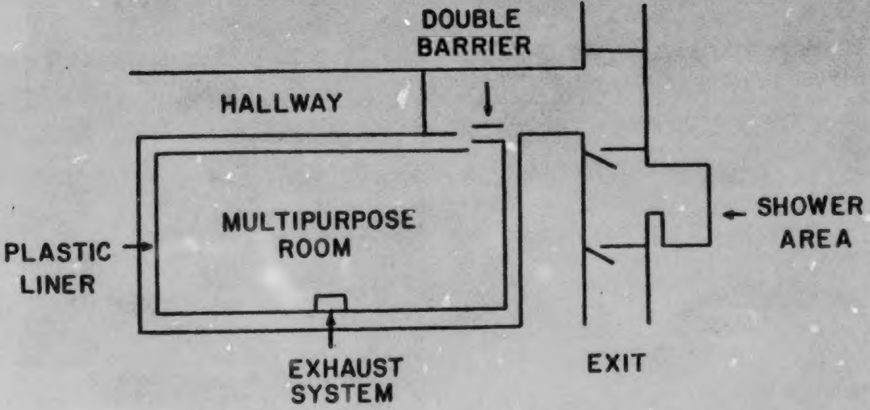
Spray application of a primer coat of sealing material. The enclosed space required the use of non-toxic solvents (e.g. water) or respiratory protection for those with toxic or irritating effects. The use of a low pressure spray pump aids in reducing the release of asbestos fibers from the surface

Figure 10

Application of the final spray coat of a sealing material.

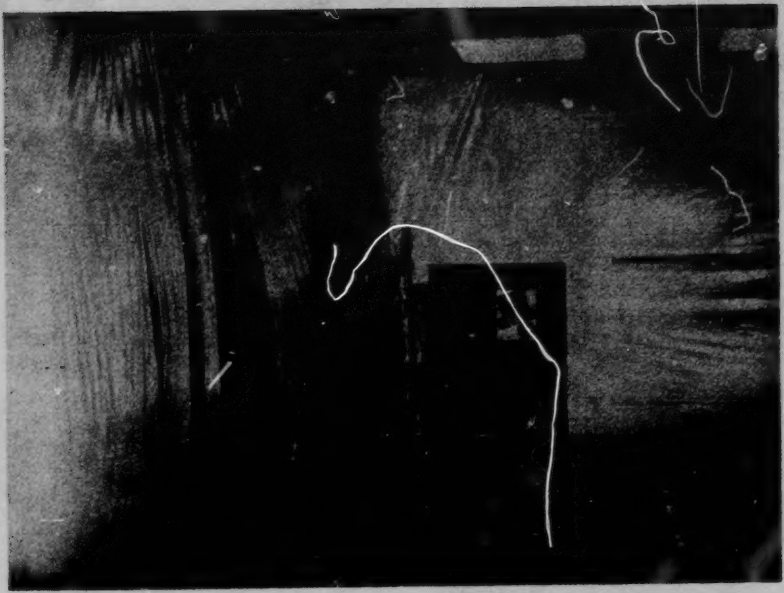
Figure 11

113


DOUBLE BARRIER
HALLWAY
MULTIPURPOSE ROOM
PLASTIC LINER
SHOWER AREA
EXHAUST SYSTEM
EXIT

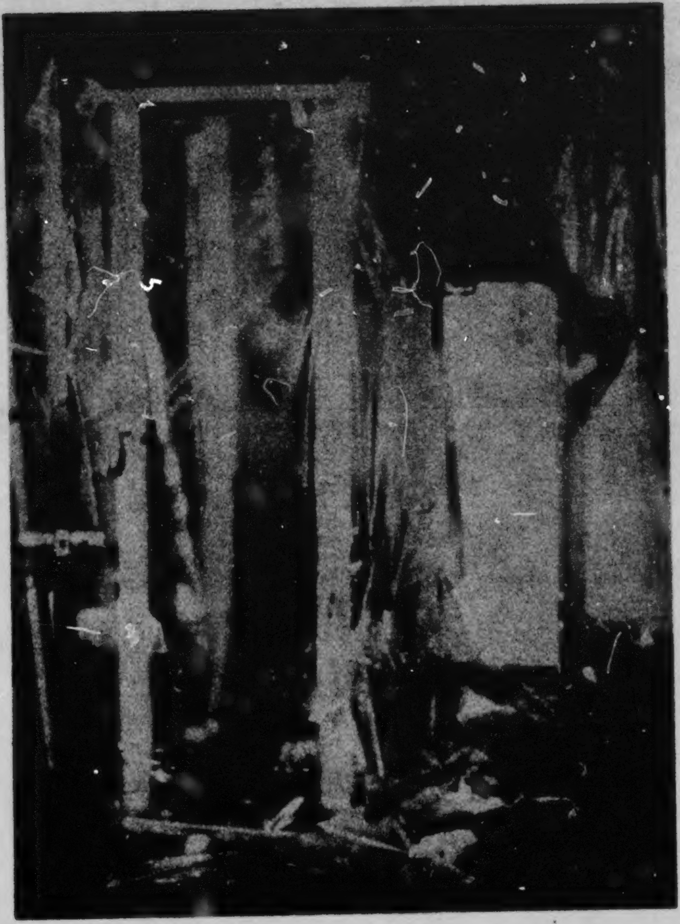
Schematic diagram of enclosure procedures for a room prior to the sealing of loosely-bonded asbestos material. A three-zone system was utilized with a work area, a decontamination area where contaminated clothes and materials were left, and a clean area with shower facilities, each separated from the others.

Figure 12



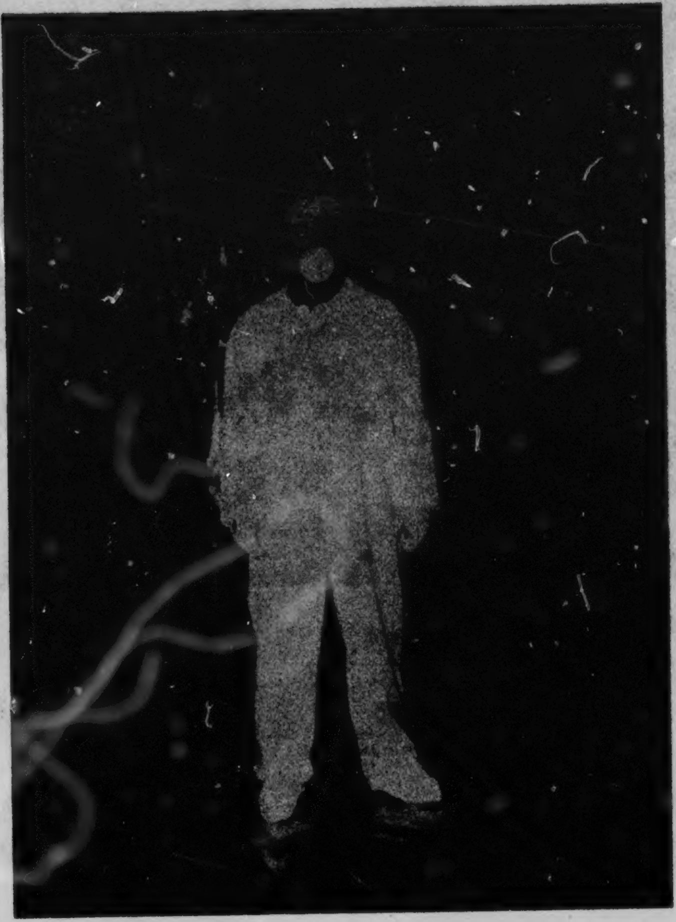
Complete enclosure of the spray area in plastic tarpaulins.

Figure 13



Double barrier door between the work area and the shower area for workmen to remove and leave contaminated clothes.

Figure 14

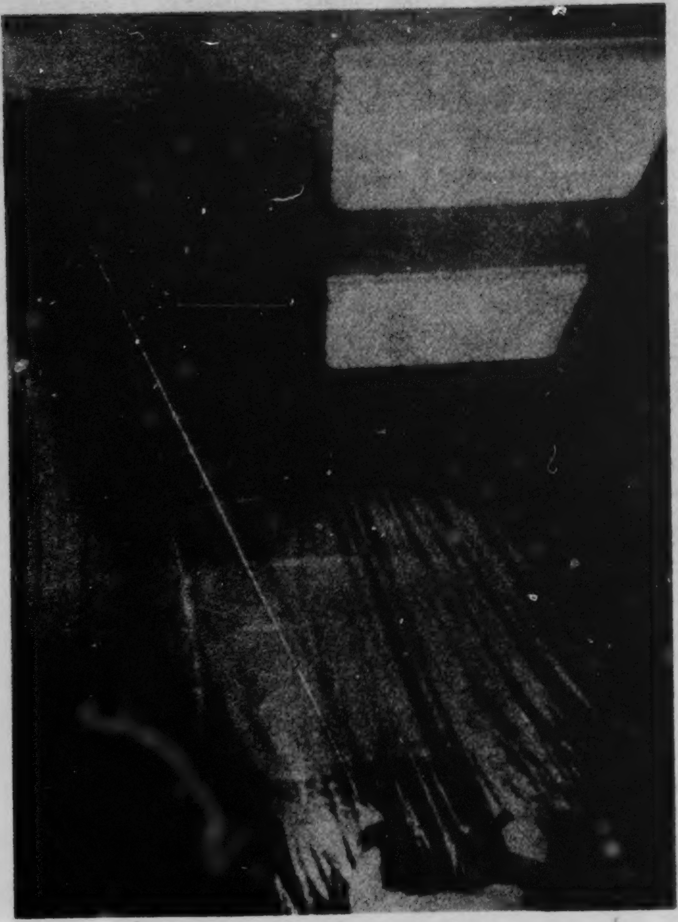


Disposable overalls and half-face mask respirator utilized during spray operations.

Figure 15

Patching and complete sealing of fixtures as required prior to the spraying of sealant material.

Figure 16



The application of sealant material with a low pressure pump.

Figure 17

Removal of asbestos from a room ceiling with a hand scraper. With complete wetting of the asbestos mixture air concentrations in the room can remain below 5 fibers/ml. The light fixtures and the room were well sealed in plastic prior to any removal work.

Figure 18

The bagging of wet asbestos scraped from the ceiling. Six mil plastic bags are suitable for this purpose. In this operation, nylon suits and half-face mask respirators were used. The suits were left at the entrance to the work area and could be utilized for several days.

Figure 19

The transport of sealed asbestos in labeled bags to an enclosed dumpster for transport to an approved disposal site.

Figure 20

After the removal of asbestos from this room the tarpaulins were taken down, disposed of as contaminated waste, the room washed, and a hung ceiling installed.

Figure 21

Chairman **Perkins**. Come around, Dr. Rall, Director, National Institute of Environmental Health Sciences, Department of Health, Education, and Welfare, accompanied by Mr. William Blakey, Deputy Assistant Secretary for Legislation. We will also hear from Mr. John DeKany, Deputy Assistant Administrator for Chemical Control, EPA.

We will hear from Dr. Rall first.

STATEMENT OF DR. DAVID RALL, DIRECTOR, NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES, DEPARTMENT OF HEALTH, EDUCATION AND WELFARE, ACCOMPANIED BY WILLIAM BLAKEY, DEPUTY ASSISTANT SECRETARY FOR LEGISLATION (EDUCATION)

Dr. **Rall**. Thank you very much, Mr. Chairman.

Let me introduce Mr. William Blakey on my left, Deputy Assistant Secretary of HEW.

I am the Director of the National Institute of Environmental Health Sciences, and an officer in the Public Health Service.

Let me first, if I may, read a letter Secretary Califano has just delivered to you.

"Dear Carl, I want to thank you for the important step you are taking today toward increasing public awareness about asbestos exposure in our nation's schools. You are providing a valuable national forum for bringing together people from public and private life to discuss this problem.

"For a number of years, as you know, the Department of HEW has supported research on the health hazards associated with asbestos exposure. Our best estimates of the increased health risks associated with asbestos exposure are based on HEW supported studies of workers heavily exposed to asbestos before the government began in the late 1960s and early 1970s to regulate asbestos in the workplace.

"Early last year I learned that more recent studies indicated that many more workers were exposed to asbestos, particularly in the World War II shipyards, than had previously been thought.

"It was clear that the resulting public health problem, cancer and other diseases appearing 20 to 30 years after exposure, was substantial. That is why I announced last April a major effort by the Department to get the word to exposed workers and the general public about the serious health risks of asbestos exposure.

"We contacted all of the nation's 400,000 physicians, notifying them of the nature of the health risks posed by asbestos. We launched a public information campaign urging people who had been exposed to asbestos to seek medical screening and advice, and to reduce their risk of lung cancer by not smoking.

"This campaign has succeeded in our judgment in raising public awareness of the health hazards posed by asbestos.

"But this was not the extent of our efforts. Because we were especially concerned about the risk to schoolchildren from asbestos in school building materials, our National Institute of Environmental Health Sciences undertook a special project to assess the content of asbestos in New Jersey school buildings and the potential risk to young children.

"The extent of this health risk to children is not now known. We do not have the long-term studies of school-age populations as we do for asbestos and shipyard workers.

"We did learn as a result of the New Jersey study that particularly where there was deterioration or damage to school buildings containing asbestos, children risk exposure to asbestos. As a result of the findings in the New Jersey school study, I promptly notified the nation's Governors of the possibility of asbestos exposure in their schools.

"In my letter to the Governors last August, which I enclose, I encouraged them to survey the situation in their States. We have offered technical assistance and informational help from HEW to State and local educational agencies as they work to deal with this problem.

"Because we at HEW are so deeply concerned with this issue, we are greatly encouraged by the commitment you are making today to increase public awareness of the potential hazards of asbestos in schools. Your hearings will add greatly to our combined knowledge and understanding of the special challenge we face in protecting the health and safety of our nation's schoolchildren.

"Sincerely, Joseph A. Califano."

[The letter to the Governors follows:]

THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE
WASHINGTON, D.C. 20201

AUG 18 1978

Dear Governor:

As you know, scientific studies have demonstrated that asbestos creates a high risk of serious lung disease for workers who have been heavily exposed to this toxic substance. As a result of these studies, concern has begun to be expressed about exposure to lower concentrations of asbestos.

At the present, however, little certainty exists about the hazards of low concentrations of asbestos. The studies involving workers exposed to high levels of asbestos do show that even short exposures, one month or less, have been followed by lung cancer. One study has reported that family members of asbestos workers -- and even people living in the neighborhood of asbestos plants -- have developed cancer. Many scientists are convinced that no level of exposure is completely safe, although lower levels may carry lower risks.

As a result of this concern, we have supported studies of environments involving lower levels of asbestos exposure. I enclose the results of one such study which I believe your State health and education officials should examine carefully.

Conducted by the Mount Sinai School of Medicine in New York, the study examined the extent to which asbestos materials were present in New Jersey schools, sampled air concentrations in the vicinity of asbestos materials in these schools, and studied the effectiveness of various techniques to control the release of asbestos into the air.

The Mount Sinai study in general confirmed the presence of asbestos materials in many of these schools and found asbestos air levels that were above background in schools in which the asbestos ceilings or other building materials were damaged or deteriorated. In three schools, the investigators found elevated air concentrations that approached occupational limits. But these levels were found only in areas of high deterioration and where the investigators simulated normal school activity that might be expected to stir asbestos dust. In general, the study found the potential for the release of asbestos into the air appeared to be directly related to the extent the material had been damaged or had deteriorated.

At this time, we simply do not know the extent of risk from the low levels of asbestos concentrations found in the New Jersey schools. There have been no studies of populations intermittently exposed to asbestos of the kind and in the amount found in these New Jersey schools. Any exposures in New Jersey schools or elsewhere as a result of asbestos building materials are likely to have been more episodic and at much lower levels than the early exposures of workers in whom significant asbestos disease has been found.

The Public Health Service has advised me, however, that any exposure probably carries some risk of disease, although it is not possible to estimate at the present time the risk from the levels of exposure observed in the New Jersey schools.

I urge that you, your Public Health officials, and your school officials review the enclosed report with care. From a public health point of view, you and your State Public Health officials will want to consider whether it is prudent to eliminate from schools and other public buildings potential sources of exposure to asbestos. The Mount Sinai report suggests that there are no technological barriers either to sealing the asbestos materials in place or to removing them.

Both the Department of Health, Education, and Welfare (HEW) and the Environmental Protection Agency (EPA) are continuing to review this question to determine whether further Federal action should be taken. Both HEW and EPA are ready to provide whatever technical assistance and further information you desire. Please feel free to contact either Dr. David Rall, Director, National Institute of Environmental Health Sciences (919/541-3201) or Mr. John DeKany at EPA (202/426-9000).

Sincerely,

Joseph A. Califano Jr.

Joseph A. Califano, Jr.

Enclosure

Dr. **Rall**. As you know, I have a long statement. I would prefer, if I may, to summarize that briefly.

Chairman **Perkins**. Go ahead. Summarize your statement. Thank you.

Dr. **Rall**. In terms of background, it might be useful to know that asbestos use in the world began in any sort of large scale in about 1880. The next 50 years saw a gradual but steady increase.

Until about World War II, the use was around 50,000 to 100,000 short-term tons annually. This increase in World War II went to about 300,000 short-term tons annually and recently has been about 800,000 short tons per year.

800,000 short tons is rather a meaningless figure. But let me say that each year for the last number of years there has been consumption of seven pounds per person per year in the United States.

Now, as Secretary Califano's letter mentioned, the studies which best define the health effects of asbestos are related to heavily exposed workers in the fifties and sixties, before there was any regulation.

The results of these studies suggest that the asbestos risk is very real indeed. For lung cancer, about 20 to 25 percent of workers exposed heavily to asbestos are likely to die of this disease. Smoking increases the risk very significantly of lung cancer.

Asbestosis, which is a chronic scarring disease of the lung, about 7 percent of heavily exposed workers die of asbestosis.

Mesothelioma is a very unusual and previously rare tumor of the lining of the chest and abdominal cavity. About 7 percent of workers heavily exposed die of mesothelioma. More recently it has been discovered that 8 to 9 percent of workers exposed to asbestos die of gastrointestinal tract cancer.

To put this in perhaps simpler terms, about 16 percent of the general American public dies of cancer today. That segment that has been heavily exposed to asbestos, perhaps as much as 35 percent, or 30 to 35 percent, will die of cancer.

HEW and the Public Health Service has been concerned about asbestos not only in the workplace but in the environment for a number of years. After the 1976 incident in New Jersey, where attention was clearly focused to the potential hazards in schools, the Center for Disease Control, National Institute for Occupational Safety and Health, in May 1977 sent a letter to State health officials, warning them of this problem and offering advice and technical assistance.

You have heard of the Nicholson study in 1977. Let me address the particular difficult issue now of the risk of asbestos exposure for the schoolchildren, the teachers and the maintenance workers.

We cannot and probably in the near future will not be able to give you precise numbers with respect to the risk of the schoolchildren. We know that at high exposures over long periods of time there is a very high risk indeed. We know that at normal ambient levels of asbestos there is essentially no risk of such problems as mesothelioma.

Somewhere in between lie the risks attributable to asbestos exposure for schoolchildren. I think it is real, I cannot and I do not think anybody can give you a number in the near future. The school exposures are more episodic and much lower levels than the heavily exposed workers. On the other hand, there is a very long latency period between exposure and the development of the cancers and the earlier one is exposed in his lifetime the longer time there is to develop in later years asbestos-induced cancer.

Secondly, for many carcinogens children seem to be more susceptible than adults. It is known that workers exposed, and the families of workers who have been exposed to asbestos seem to have more mesothelioma and evidence of pulmonary signs of asbestos exposure than does the general population, and there are a number of studies on the incidence of mesothelioma in areas around asbestos factories and mills. Almost all of these studies show there is an increased risk of mesothelioma simply in the vicinity of asbestos factories.

It should be pointed out asbestos exposure in this situation is not limited to schools. EPA banned the use of this material in 1973 but there are many public buildings and commercial buildings which presumably have such sprayed asbestos.

Let me just add parenthetically, Mr. Chairman, that a Mt. Sinai group a couple of years ago, because of my concern, surveyed the offices of the House of Representatives and the Senators and found that these buildings are very well constructed and there is no asbestos exposure in these buildings and I think that at least might be reassuring to some of you.

Let me, in closing, repeat the recommendations in Secretary Califano's letter to the governors in 1978:

The top priority should be for removal of badly deteriorated, damaged and flaking material. This is clear and I think it is obvious.

The second priority should be to deal with surfaces which can be sealed. Sealing is simpler and less expensive and less disruptive.

The last priority should be in tack surfaces which contain asbestos but which are not in danger of flaking or deteriorating. These may well in the future need attention but for the moment should be at the last priority.

With teenage smoking we would urge those potentially exposed to either stop or never start smoking. Although DHEW has no general authority to assist school districts with repair or renovation, there is some possibility of demonstration funds either available through the Elementary and Secondary Education Act or through the Division of Cancer Control of the National Cancer Institute. NCI is developing plans for at least one demonstration project to provide education to students, school personnel and contractors doing the removal and sealing, to develop better quality control; of tests for asbestos fibers.

Chairman PERKINS. Dr. Rall, I think that for all intents and purposes that does conclude your statement. But since you have suggested there that the Department of Health, Education, and Welfare has no general authority to assist those school districts with repair or renovation of school buildings which have become health hazards, there is the possibility of research and demonstration funds under the Elementary and Secondary Education Act, although funding under this authority is limited.

I personally feel that we have a Federal responsibility here and in view of the controversy existing and the conditions existing throughout the nation, I feel that we should make an early decision as to whether we are going to accept responsibility. If we are not, we should throw the ball back to the States at an early date.

But assuming that we may accept responsibility, could you offer a suggestion, after chatting with the Secretary of HEW, to the Appropriations Committee to go along with the maximum funding of the research sections of the Elementary and Secondary Education Act so that we could assist in removing the dangerous conditions throughout the nation?

Do you think you may do that within the next week?

Dr. **Rall**. I will carry the message back very vigorously.

Chairman **Perkins**. That is all we can ask of you.

Go ahead, Mr. Miller.

Mr. **Miller**. Thank you, Mr. Chairman.

Dr. Rall, I wonder if you would comment on the statement by Dr. Nicholson that the level which should be tolerated in the schools is no greater than the general background level in terms of asbestos ambient air levels?

Dr. **Rall**. Although that is a very broad and sweeping statement, I think it is correct. I do not think we should have schoolchildren, teachers and maintenance workers in an environment that provides an added risk, even though certainly at levels that are just barely above the ambient, the normal this risk must be very low indeed. But I think as a principle, as a goal, that is what we ought to have in mind.

Mr. **Miller**. Well, I am glad to hear you say that because, while I tend to agree that we must look at the range of those levels in the schools, and it is easy to talk about the schools where you have 100 times the normal background, nevertheless, I think it can be shown through the testimony already received by the other subcommittee that we have a significant number of recorded cases of people who were exposed for what appears to be very low levels; they were office workers in shipyards, they were inspectors, again there were families of workers, they lived in the general vicinity as you pointed out in your testimony, and we have seen these cases come to pass.

I think that we certainly have to show a concern for these children who have that exposure. Now you have outlined a program which HEW has undertaken to notify the governors to ask for a survey of their State schools for asbestos contamination. Can you tell me what the results of that have been to date?

Dr. **Rall**. We have received communications from perhaps 15 or 20 States but about that time the Environmental Protection Agency initiated a telephone survey and this appeared to divert the responses to the Environmental Protection Agency. So we think our responses were incomplete. When the Environmental Protection Agency called each office to see what they were planning to do or what had been done, this opened the channel between EPA and the State offices.

Mr. **Miller**. Has any effort been made to coordinate whether or not we now have answers from 50 States?

Dr. RALL. Yes, we are working closely with EPA in training our regional officers and developing quality assurance programs for asbestos analysis.

Mr. MILLER. Do we know anything about how those surveys were conducted? Did people simply look to see whether there was asbestos in the facility, whether it was deteriorating, whether students were exposed to it?

Dr. RALL. We know the quality of the surveys was quite variable but I think perhaps you will get better information from Mr. DeKany from EPA, whose people actually talked to the governors' offices.

Mr. MILLER. Well then, is HEW going to continue with trying to find out the results of this survey?

Dr. RALL. Yes, indeed.

Mr. MILLER. It does not sound like a very valuable tool to me.

Dr. RALL. What do you mean?

Mr. MILLER. It means we have a survey that is incomplete and a survey of which apparently the controls over how it was done were, how would you say, widely variable. I do not understand. That does not sound like something I want to hang my hat on.

Dr. RALL. We are I think talking at cross purposes. EPA has the regulatory responsibility in this area. And we deferred to them when they began surveying the States to determine what action was being taken, what surveys were going on. That is why I have not kept up to date on that and suggest that you refer that question to EPA.

Mr. MILLER. All right. We shall do that.

You say in your testimony on page 4 that school exposures are likely to have been more episodic and at much lower levels than the exposures of workers in whom asbestos-related disease has been found and which provide the basis for the numbers that you described earlier. But we are still talking, are we not, about young children who will spend five hours a day, what is it, in that facility or around that facility?

Dr. RALL. Oh, yes.

Mr. MILLER. For nine months of the year?

Dr. RALL. What I was saying was that really the horrendous figures I quoted for mortality are heavy regular exposure. Do not equate those with the exposure in the schools. Again I do not know where, from ambient level, very low exposure, essentially no effect, to the very high exposure in the pre-1970 occupational situation, where the schoolchildren will fall on that curve.

Mr. MILLER. None of us will know for about 20 years?

Dr. RALL. Or 30 years.

Schoolchildren in an epidemiological sense are very hard to follow; they move, about half of them change their name. We are considering working on the possibility of setting up some epidemiological studies but frankly, our epidemiologists think it will be very difficult to get good solid information on that. But if you go back to what Dr. Nicholson reported, the family contacts and the people who live in the vicinity of asbestos plants, factories, there is an increased risk.

Mr. MILLER. So while we may not know where to exactly place these children in terms of on the risk chart, it would be fair to say that HEW thinks we ought to be concerned about that risk?

Dr. Rall. Definitely.

Mr. Miller. And I was a little concerned when I heard your testimony read the first time that there was a tendency to minimize the impact of that potential risk because we do not know yet where to place it, but I would prefer that we not wait until we see what has happened now in terms of the older populations to determine what that risk is with these children. If we are not going to have evidence, maybe the children will have it in ten years. That may be good for the studies of the risk but not very good for the children.

Dr. Rall. As a Public Health Service officer, I am convinced there is a risk. I am convinced, as are most of my scientific colleagues, that there is no threshold for this sort of carcinogenic effect. So that any exposure above background creates an added risk. If there is just a little exposure above background, it will be a very light added risk but as that as an exposure above background gets larger and larger, you will have a larger and larger risk.

Mr. Miller. Well, I appreciate those remarks because I think that is going to be very helpful if that is a correct statement of the Department's view. I think we are going to work very well in trying to deal with this problem.

I am concerned that we properly assess the magnitude of the problem before we run in to unload our solution on the problem.

As you may know, I do not know if you know, but late last night there was a discussion on the news that the six schools in Montgomery County, when originally surveyed, said they have no hazard. They have been resurveyed using better scientific methods, and people are suggesting there is a hazard. That is why I am worried about a simple survey by a governor's office as to whether in fact there is asbestos contamination.

I would suspect those surveys, other than identifying schools where asbestos is in fact in place, do very little to tell us about the contamination about the air levels in those facilities.

Thank you very much.

[Prepared statement of Dr. Rall follows:]

STATEMENT OF
DR. DAVID P. RALL
DIRECTOR, NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES

Mr. Chairman and Members of the Committee:

I am pleased to be here to discuss what is known, and what remains to be learned about possible health effects of asbestos in some of our nation's schools.

Introduction

Since this is my first opportunity to appear before the Subcommittee, I would like to describe briefly the role and mission of the National Institute of Environmental Health Sciences. NIEHS is one of the eleven National Institutes of Health--the major research agency of the Public Health Service. While most of the other Institutes are concerned with classes of diseases, specific organ systems, or developmental processes, NIEHS is concerned with any disease or health problem stemming from exposure to toxic environmental agents. Specifically we are charged with improving understanding of the mechanisms of all human diseases and disorders with environmental origins. In carrying out our mission, we work closely with the other NIH Institutes and HEW agencies, with the regulatory agencies who must apply scientific knowledge to standard setting, and with the scientific community at large.

General Background on Asbestos

As background to our discussion of asbestos exposure in our nation's schools, I would like to summarize the state of our knowledge about asbestos and the possible health hazards associated with its use.

Asbestos is the common name for a group of minerals that occur as masses of compact fibers. The substance has been used in small amounts for thousands of years. Modern industrial use in the United States began in about 1880, with the mining of Canadian chrysotile asbestos deposits. Gradual increases in production and use occurred during the next 50 years. Prior to World War II usage averaged around 300,000 short tons per year. Since then, until 1970, the use has varied between 600,000 and 800,000 short tons. During the five years ending in 1975 the amount of asbestos fiber utilized in this country averaged some 800,000 short tons annually (according to the U.S. Bureau of Mines). This represents about 7 pounds a year for every American, adult and child.

The best estimates of the increased risks associated with asbestos exposure are based on HEW's NIEHS supported studies of workers regularly and heavily exposed to asbestos before the government began to regulate asbestos in the workplace in the late 1960's and early 1970's.

The risks for past workers regularly exposed to asbestos are estimated to be as follows:

Lung Cancer. A non-smoker who has been exposed to asbestos is three to four times more likely to develop lung cancer than a non-smoker who has not been exposed. However, a smoker who has been exposed to asbestos is up to 90 times more likely to incur lung cancer than a non-smoker who has not been exposed, and up to 30 times as likely to incur lung cancer as a non-smoker who has been exposed.

At present, it is estimated that 20-25 percent of workers (both smokers and non-smokers) exposed to asbestos before the era of government regulation are expected to die of lung cancer. The risk decreases for those who stop smoking.

Asbestosis. Only individuals exposed to asbestos contract asbestosis which afflicts approximately 7 percent of the number of workers heavily exposed in the past. Asbestosis is an irreversible and progressively disabling lung disease that impairs breathing. Individuals with the disease are much more likely to die of respiratory ailments, like pneumonia, than individuals who do not have asbestosis.

Mesothelioma. This is a cancer of the lining of the chest or abdominal cavity and is almost always associated with prior asbestos exposure. Approximately 7-10 percent of those heavily exposed to asbestos in the past die of this cancer.

Gastro-intestinal cancer. Individuals exposed to asbestos in the past are estimated to be about twice as likely to die of gastro-intestinal cancers -- including cancers of the esophagus, stomach and colon -- as non-asbestos exposed individuals. Approximately 8-9 percent of asbestos-exposed individuals die of these types of cancer.

Asbestos Exposure in Schools

The asbestos hazard would be serious enough if workers were the only group at risk, but there is some evidence to indicate that much lower levels of exposure to asbestos than that found in the work place are capable of producing asbestos-related disease. As a result of concern over asbestos exposure in the New Jersey schools the Public Health Service (CDC, CDC/NIOSH) in May 1977 notified all state health departments through HEW Regional Offices of the potential hazard of asbestos in schools and other buildings. In that same year NIEHS supported a study of asbestos exposure in New Jersey schools conducted by Dr. Nicholson of Mt. Sinai. This study confirmed the presence of asbestos materials in about 11% of the state's schools. In addition, asbestos air levels were found that were above normal in schools in which the asbestos ceilings were damaged or deteriorated. The potential for the release of asbestos into the air appeared to be directly related to the extent the material had been damaged or had deteriorated.

The extent of risk from the low levels of asbestos concentrations found in the New Jersey schools and elsewhere is not now known. There have been no studies of populations intermittently exposed to asbestos of the kind and in the amount found in schools. What is known is that asbestos causes specific diseases, asbestosis and mesothelioma, and that occupational exposures to high levels of asbestos decades ago have led to excess gastrointestinal and lung cancers in these workers. Research involving workers exposed in the past to high levels of asbestos has shown that even short exposures, one month or less, have been followed by cancer. Studies of past exposure for family members of asbestos workers and even people living in the neighborhood of asbestos plants show the development of cancer. Animal studies--of animals exposed for as little as one day to high concentrations of asbestos dust--support what has been seen in humans.

Many scientists are convinced that no level of exposure is completely safe--although lower levels certainly carry lower risks. The conclusion is that exposure means risk, but it is not possible today to relate exposure to risk in a quantitative sense. The school exposures are likely to have been more episodic and at much lower levels than the exposures of workers in whom asbestos-related disease has been found and which provide the basis for the numbers I have described.

In assessing the relative risk for children there are two points to be noted: With the long latency period of asbestos-associated disease, (and the length of the latency period appears related to the intensity of exposure) children exposed to asbestos at an early age could show symptoms of exposure much earlier in their lifetime than those exposed in adulthood. There is also concern based on the fact that children have shown an enhanced susceptibility to certain other environmental hazards because of their rapid rate of growth and development.

Other sources of exposure

The type exposure detected by Dr. Nicholson is not limited to the schools. Since 1935, until this use was banned in 1973 by EPA, sprayed asbestos was used for acoustical, fireproofing and decorative purposes in building construction across the United States. It has been used in many of the multi-storied buildings in the country. It was in 1975 that scientists at Mt. Sinai reported evidence of this material eroding with age and releasing asbestos fibers into the indoor air of New York buildings.

DHEW Recommendations

Deeply concerned about the situation in the schools, Secretary Califano sent a letter on August 18th of last year to the Governors alerting them to possible health hazards from asbestos-containing materials in school buildings. He encouraged them to survey their states' schools for asbestos contamination. In his letter the Secretary offered the technical assistance and informational resources of the Department of Health, Education, & Welfare.

The Department is recommending that the issue be addressed on a case-by-case basis. When the asbestos-containing material is in such bad shape that possible asbestos release can be prevented only by removal, this should be top priority. Secondly, emphasis should be placed on surfaces which are in badly damaged or deteriorated condition and which are amenable to sealing techniques. Lower priorities can be given to lesser degrees of damage or deterioration. Lowest priority should be given to intact surfaces; although in time, these too, will probably need to be corrected.

It is recommended that individuals already exposed to above normal asbestos in the air stop smoking or never start. Cessation of smoking reduces the increased risk of lung cancer for smokers exposed to asbestos.

While the Department of Health, Education, and Welfare has no general authority to assist local school districts with the repair or renovation of school buildings which have become health hazards, there is the possibility of research and demonstration funds under the Elementary and Secondary Education Act, although funding under this authority is limited.

In addition a demonstration project which deals directly with asbestos in schools is planned for funding by the National Cancer Institute this fiscal year. The demonstration will focus primarily on three aspects of the problem: 1) the health education of students and school personnel, and the education of contractors and construction workers involved in the removal or sealing of asbestos materials; 2) the development of a management approach for organizing the removal or sealing of the asbestos material which can be applied to all school systems which are affected by the problem; 3) the development of quality control of tests to measure asbestos fibers.

Conclusion

The Department is actively continuing to address this problem. We are working closely with the Environmental Protection Agency in development of a program of technical assistance to state and local officials in the identification and abatement of asbestos hazards in schools. The Regional offices of both HEW and EPA will serve as focal points for this effort. Staff will participate in joint training sessions to enable them to provide technical assistance to concerned school districts. We hope that through the concerted efforts of all levels of government, the scientific community, the students, their families, and educational staffs, we can develop viable approaches to this troubling issue. I would be happy to answer any questions you may have.

Chairman PERKINS. Mr. Weiss.

Mr. WEISS. Thank you, Mr. Chairman. Dr. Rall, has the Department undertaken any consideration of additional regulations or legislation to control the use of materials containing asbestos?

Dr. RALL. HEW has no regulatory responsibility in this area. Insofar as we had it, some years ago it was transferred in 1971 to the Environmental Protection Agency. But let me spend a moment and say what the Department is considering.

Mr. WEISS. Please.

Dr. RALL. When Secretary Califano announced the asbestos awareness program last spring he set up an asbestos task force with Dr. Arthur Upton, the Director of the National Cancer Institute, and myself as cochairmen. Among the issues that we are actively studying are the problems of surveillance of heavily exposed workers. This is a major problem and there are no easy answers. We are considering research problems such as the possibility of an epidemiological study of schoolchildren, the problems of technical competence in measuring asbestos—I personally am concerned that there are not enough technically competent, reliable laboratories in the country to handle the load of testing ceilings and so forth for asbestos—and third, our task force is looking at possible legislative proposals in this whole area. We are in the midst of this discussion in planning and we will get back to you as soon as we come forth with any recommendations.

Mr. WEISS. The Subcommittee would appreciate your recommendations. But you are not suggesting that the Secretary has no authority to express the Department's concern about hazardous conditions or situations even though the power of regulation may reside in some other department or agency, are you?

Dr. RALL. I think in the spring when Secretary Califano announced the asbestos awareness program he was doing just that.

Mr. WEISS. Therefore even though the responsibility for regulation may now lie with EPA it would not in your judgment, or in the

Secretary's judgment, be inappropriate for the Secretary to conclude, for example, that asbestos containing material which is used for insulation, acoustical purposes or whatever, should not be used in school settings where children are likely to be exposed to the substance.

Dr. Rall. I think that would be a perfectly reasonable thing for him to announce.

Mr. Weiss. And is that kind of survey part of the responsibility of the task force that you have spoken of?

Dr. Rall. Yes, it is included.

Mr. Weiss. Thank you very much.

Thank you, Mr. Chairman.

Chairman Perkins. One further question, Dr. Rall. You made mention about the inadequacy of the laboratories of the country to test for the presence of various types of asbestos in the school systems of the country.

Considering the knowledge that you already have at hand, is there any doubt in your mind that the asbestos, wherever it may be, regardless of the type, should not be removed as soon as possible?

Dr. Rall. I agree with the thrust of what you said but not the details. Let me go back to the priorities for removal that we discussed a few moments ago. Let me start at the bottom, the lowest priority. Some asbestos is highly and tightly bound in what is really cement. Now I think in the long term we should be concerned about it, but that to me, although it is an asbestos-containing material, would have the lowest priority for removal or encapsulation.

On the other hand when you have an asbestos surface that is friable, flaking, damaged, yes, I think that should be either encapsulated if feasible or removed.

Chairman Perkins. Without waiting for any further studies?

Dr. Rall. If you can show—my personal belief is that if you can show the material is friable and has a high asbestos content, I think it should be removed in a timely manner. Now if it is holding together well and not showing evidence of flaking, timely manner does not mean tomorrow. It can wait for summer vacation, or if it is staying in shape, for the next summer's vacation. The place where I would look to be the major problem was the damaged, flaking ceilings that you can literally see material falling down from. That I think ought to be the first priority with sealing or removal being done as soon as it is feasible.

Chairman Perkins. Any further questions? Thank you.

Dr. Rall. Thank you.

Chairman Perkins. Does the gentleman accompanying you, Dr. Rall, wish to say anything?

Mr. Blakey. I did not have anything to say, Mr. Chairman, in particular. There is as you know under the public law in some of our own schools which OE runs, itself, about 139 of them which we are looking at very closely, have already done a preliminary examination of, and we think a small number of those 139 schools do have asbestos problems, but they are being looked at right now.

Chairman Perkins. Thank you very much. All right, we will go back to Dr. Sawyer, Yale University. I understand that he now has his slides and he is ready to move. Come around, Dr. Sawyer.

STATEMENT OF ROBERT SAWYER, YALE UNIVERSITY

Dr. Sawyer. Mr. Chairman, I have attempted to make a sufficient presentation and thought slides would help out. I apologize for all the trouble it has caused.

Chairman Perkins. Go right ahead.

Dr. Sawyer. We cannot have lights on during my presentation.

Chairman Perkins. Who is going to regulate the lights, turn the lights out? We cannot see the slides.

Dr. Sawyer. This is totally show and tell.

Chairman Perkins. We will get somebody out there to turn the lights out. Let me ask you, are those television lights going to interfere, will the television light interfere?

Dr. Sawyer. It looks like it will.

Chairman Perkins. All right.

Dr. Sawyer. I would like you to be able to see the slides, whatever that takes.

Chairman Perkins. All right. Get somebody to find those switches around there and turn these lights out.

Dr. Sawyer. Is that good enough for you, sir?

Chairman Perkins. Can you see now?

Dr. Sawyer. It is up to you.

Chairman Perkins. No, we cannot.

Dr. Sawyer. All right. I have seen these so many times I just do not have to look at them anymore.

Chairman Perkins. All right. Now we can see it. Go ahead.

[The information follows:]

INDOOR ASBESTOS POLLUTION: APPLICATION OF HAZARD CRITERIA

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This paper was presented at the end of June, 1978 as a part of Science Week sponsored by the New York Academy of Sciences. It will be published the Spring of 1979 in an Annal of the New York Academy of Sciences entitled "Health Hazards of Asbestos Exposure".

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Robert N. Sawyer, M.D.

Yale University

June 27, 1978

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of Asbestos Exposure

Consideration of the physical characteristics of asbestos fibers, and the widespread and varied sources of asbestos containing materials have produced concern over exposure potential within buildings, structures, or ships that contain such materials. The hazard potential from such exposure has been difficult to estimate. Contamination and exposure levels have not been well documented, and both measurement technology and epidemiology were considered faulty. However, appropriate contamination data have been accumulating, and the potentially associated hazard may be at least approximated using the current and proposed exposure standards developed for occupational populations.

Relevant characteristics of asbestos fibers: Fibers of the asbestiform minerals have durability and aerodynamic capability, and both characteristics enhance their hazard potential. The fibers resist degradation under most conditions with persistance of their biologic effects and hazard potential. The fibers exhibit low settling velocities. As calculated from settling curves generated for asbestos fibers, a 1.0 micrometer fiber with 5:1 aspect ratio falling from 3 meters with variable axis attitude will exhibit a settling velocity of 10^{-3} cm/second, and remain airborne for 80 hours.[1] Further, settled fibers have aerodynamic capability and may enter reentrainment cycles if disturbed and again enter the environment. Such fibers, relatively contained within a structure, can repeatedly present an exposure situation and an opportunity for inhalation or ingestion.

Asbestos materials in structures: The asbestiform minerals are incombustible and possess relatively high tensile strength, insulating properties and chemical resistance. These characterisitcs have made asbestos the material of choice or an essential component in a wide spectrum of applications. Asbestos is present in many forms in numerous structures, and indeed most asbestos produced enters the construction industry.[2] Asbestos containing material may be present in existing components of structures and also in material introduced during the life of the structure. Existing component material may include friable sprayed material on walls and ceilings, pipe lagging, panels, tiles, and miscellaneous cementitious materials. Introduced material containing asbestos fibers may include renovation material such as panels, tiles, cements, paints, matting, and spackling. Clothing contaminated with asbestos, community air or water, and miscellaneous materials such as fireplace ash can also pollute the indoor environment.

The potential for fibers entering the environment will depend upon both material and structure form and use. Fiber dissemination is also a function of the frequency and amount of energy delivered to the asbestos containing material.

Although minor in proportion of overall asbestos material applications, sprayed friable asbestos containing material is an effective fiber dissemination system and represents a major fiber source. Sprayed material has been used extensively for insulation and fireproofing, and because of widespread use and ease of fiber dissemination can be considered the most significant source of asbestos fibers in the indoor environment.[1]

Modes of fiber release from indoor materials: The methods of release of asbestos fibers have been considered to be fallout, contact, and reentrainment.[3]

Fallout of fibers is considered a result of aging and degradation of the bonding material in an asbestos containing material. It is usually low level, continuous, and may increase with the age of the structure. It represents a source of fallen fibers which may accumulate over a period of time.

Contact with asbestos containing material may be accidental, capricious, or intentionally destructive.Specific actions include striking, cutting, machining, or penetration of the material. Such contact disturbs the integrity of the matrix and results in fiber dissemination. The more friable forms of asbestos containing material are readily susceptible to damage or disturbance. Even spraying friable surfaces with paints or sealants will cause fiber release.[1,4] Solid or bonded asbestos materials will also release fibers if subjected to sufficient force.[4,5,11]

Reentrainment of fallen debris and dust containing asbestos by activities such as dusting or sweeping will resuspend accumulated fibers in the atmosphere. Generally, the reentrainment effect is proportional to the level of activity within the structure space.[3,6]

Contamination studies: The indoor environment has been investigated. Sampling for asbestos fibers has been performed in numerous structures under variable conditions of activity, usually in non-occupational settings in apartment buildings, offices, schools, and private homes.

Methodology: The data presented were obtained by optical microscopy and the standard phase contrast counting technique.[7] Although the

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technique enumerates all particles with aspect ratios of at least 3:1, is non-specific for asbestos, and excludes fibrous particles shorter than 5 microns, it does have the features of standardization and fair to good reproducibility.

Contamination data obtained by electron microscopy (EM), both scanning and transmission has also been accumulating. There is presently no workable accepted standard methodology for electron microscopy, and EM techniques have been disappointing in the level of agreement among examining facilities. Each study must be individually considered and interpreted. The accumulated EM data are not presented here but are available elsewhere.[1]

Contamination data: Table 1 includes both surveillance and reenactment studies. Fiber sources were considered as either friable or bonded materials, and the data is categorized in ten general activity classifications, along with the mode of contamination that best decribes the means of fiber dissemination.

* TABLE 1 HERE *

A five cycle semi-log plot is used to display the wide spectrum of contamination data listed in Table 1. The ranges of fiber concentrations for the 10 listed aetivity classifications are exhibited in Figure 1.

* FIGURE 1 HERE *

Hazard estimation: To estimate potential hazard associated with the environmental contamination levels of Table 1, approximations are necessary since no standards apply to the general indoor environment. The only standards whatsoever are the existing and proposed regulations of the Occupational Safety and Health Administration (OSHA), and the revised recommended standard of the National Institute for Occupational Safety and Health (NIOSH).[13-16] All apply to exposure of occupational populations. The subject population differs in some significant aspects. It is inclusive in age distribution, and quite variable in behavior and activity. General population exposures are extremely variable, difficult to evaluate, and in some cases are continuous over long periods of time.

The applicability of the occupational regulations in this situation has merit in that the standard optical microscopy method is utilized and the regulations, both existing and proposed, represent a distillate or summary of both exposure and epidemiologic information. This is especially true if it is assumed that the recently proposed regulation changes reflect not only additional relevant epidemiologic evidence, but also an increasing concern for the protection of the target population. The use of the occupational exposure limits is thus considered an acceptable system for at least approximating the extent of hazard from asbestos contamination in the indoor environment.

Table 2 outlines the occupational exposure limits from 1972 to the present, and lists the OSHA original, present, and proposed, and the NIOSH amended proposed regulations.

* TABLE 2 HERE *

Figure 2 illustrates the intersection of the present OSHA regulations with the diagrammed ranges of fiber counts under the various activity conditions.

* FIGURE 2 HERE *

Figure 2 demonstrates that some routine activities, such as maintenance and custodial activities, can exceed present OSHA limits (t.w.a.). Occasional events such as removal, renovation, vandalism (contact mode categories) exceed the ceiling limit of 10 f/cm^3 .

The present 2.0 f/cm^3 (t.w.a.) and 10.0 f/cm^3 (ceiling) limits were set by the 1972 regulations to become effective in 1976.[13] The more recent limits listed in Table 2, the 1975 proposed and the 1977 revised recommended, reflected the increasing awareness in asbestos disease epidemiology and are more stringent.[15,16] Figure 3 and Figure 4 illustrate the intersection of these 1975 and 1977 limits respectively with the diagrammed ranges of fiber counts under various activity conditions.

* FIGURE 3 HERE *

* FIGURE 4 HERE *

With each successive display, the range of activities which could be considered hazardous becomes more inclusive. The activities remaining outside.the limits in figure 4 are only in the categories of quiet and some nonspecific routine.

Discussion: Indoor asbestos pollution has been considered, and a set of hazard criteria was selected and applied with an understanding of the significant assumptions and approximations involved. The optical microscopy data indicate that in some circumstances contamination can exceed levels considered hazardous. Exposures are occuring within existing structures, and the population involved is large and varied in age, occupation, and behavior.

Summary: Asbestos contamination of relatively contained environments within structures can occur under a number of conditions and in association with various activities. Such contamination persists and can potentially expose all structure users. The more significant contamination levels are associated with disturbance of friable asbestos containing materials, although bonded material is also capable of fiber dissemination under special conditions.

Application of occupational government standards for limitation of exposure, both presently in force and proposed or recommended, indicates that levels found in some instances exceed those considered potentially carcinogenic.

References

1. U.S. Environmental Protection Agency. 1978. Hazard abatement from Sprayed Asbestos-Containing Material in Buildings: A Guidance Document. Research Triangle Park, North Carolina EPA-68-02-2607.
2. SPEIL, S. & J.P.LEINEWEBER.1969. Asbestos minerals in modern technology. Environ. Res. 2:166-208.
3. SAWYER, R.N. 1976. Yale Art and Architecture Building: Asbestos contamination past, present, and future. The Institute of Electrical and Electronics Engineers, Inc. Ann. No. 75CH1004-I-20-5.
4. ROHL, A.N. & R.N. SAWYER. 1978. Mt. Sinai Environmental Sciences Laboratory and Yale University. Unpublished data.
5. NICHOLSON, W.J. 1978. Chrysotile Asbestos in Air Samples Collected in Puerto Rico. Report to The Consumer Products Safety Commission March 16, 1978. CPSC 77128000.
6. LUMLEY, K.P.S., P.G. HARRIES & F.J. O'KELLY. 1971. Buildings Insulated with Sprayed Asbestos: A Potential Hazard. Ann. Occup. Hyg. Vol 14, pp.255-257.
7. BAYER, S.G., R.D. ZUMWALDE & T.A. BROWN. 1969. Equipment and procedures for mounting millipore filters and counting asbestos fibers by phase contrast microscopy. Available from U.S. Dept. H.E.W., National Institute for Occupational Safety and Health, 1014 Broadway, Cincinnati, Ohio 45202.
8. SAWYER, R.N. 1977. Asbestos exposure in a Yale building: analysis and resolution. Environ. Res. 13:1: 146-168.
9. BROWN, H.V. 1977. Office Environmental Health and Safety, UCLA, L.A., Calif. Personal communication.
10. MURPHY, R.L., B.W. LEVINE, F.J. AL BAZZAZ, J.J. LYNCH & W.A. BURGESS. 1971. Case reports: Floor tile installation as a source of asbestos exposure. Amer. Rev. Resp. Dis. 104: 576-580.

11. SAWYER, R.N. & E.J. SWOSZOWSKI. Yale University. Unpublished data. 1978.

12. ROHL, A.N., A.M. LANGER, I.J. SELIKOFF & W.J. NICHOLSON. 1975. Exposure to asbestos in the use of consumer spackling, patching, and taping compound. Science 189: 551-553.

13. U.S. Department of Labor. Occupational Safety and Health Administration. 29 CFR 1910.93a. Standard for Exposure to Asbestos. Fed. Reg., 37(110). June 7, 1972.

14. U.S. Department of Labor. Occupational Safety and Health Administration. 29 CFR 1910.1001. Standard for Exposure to Asbestos. Fed. Reg., 40 (103). May 28, 1975.

15. U.S. Department of Labor. Occupational Safety and Health Administration. 29 CFR 1910. Occupational Exposure to Asbestos. Notice of proposed rulemaking. Fed. Reg., 40(197). October 9, 1975.

16. U.S. Department of Health, Education, and Welfare. National Institute for Occupational Safety and Health. Revised Recommended Asbestos Standard. 77-169. 1977.

Table 1: Airborne Asbestos in Buildings

A: Friable asbestos material

Activity classification	Main mode of contamination	Activity description	Mean count fibers/cm^3	n	Range or s.d.	Reference numbers
Quiet	fallout	none	0.0	32	0.0	1,4,11
Nonspecific routine	reentrainment	dormitory	0.1	NA	0.0-0.8	9
		university, schools	0.1	47	0.1	8,1,11
		offices	0.2	14	0.1-0.6	1,11
Maintenance	contact	relamping	1.4	2	0.1	8
		plumbing	1.2	6	0.1-2.4	4,11
		cable movement	0.9	4	0.2-3.2	11
Custodial	mixed: contact reentrainment	cleaning	15.5	3	6.7	8
	reentrainment	dry sweeping	1.6	5	0.7	8
		dry dusting	4.0	6	1.3	8
		bystander	0.3	3	0.3	8
		heavy dusting	2.8	9	1.6	1
Renovation	mixed: contact reentrainment	ceiling repair	17.7	8	8.2	1
		track light	7.7	6	2.9	8
		hanging light	1.1	5	0.8	8
		partition	3.1	4	1.1	8
		pipe lagging	4.1	8	1.8-5.8	1
Laundry	reentrainment	contaminated clothing	0.4	12	0.0-1.2	8
Vandalism	contact	ceiling damage	12.8	5	8.0	4,11
Removal, dry	contact	stripping	82.2	11	22.4-117.0	8
Removal, wet amended	contact	stripping	2.8	56	2.4	1
Machining, abrading	contact	drilling	3.4	7	1.0-5.8	11

B: Bonded asbestos material

Activity classification	Main mode of contamination	Activity description	Mean count fibers/cm^3	n	Range or s.d.	Reference numbers
Removal, wet amended	contact	stripping (cementitious)	0.5	5	1.2	1
Machining, abrading	contact	sanding (tiles)	1.2	2	1.2-1.3	10
		sanding (concrete)	7.2	6	2.1	11
		cutting (concrete)	6.3	14	2.3	11
		grinding (concrete)	0.3	6	0.2	11
		sanding (taping)	5.3	11	1.3-16.9	12

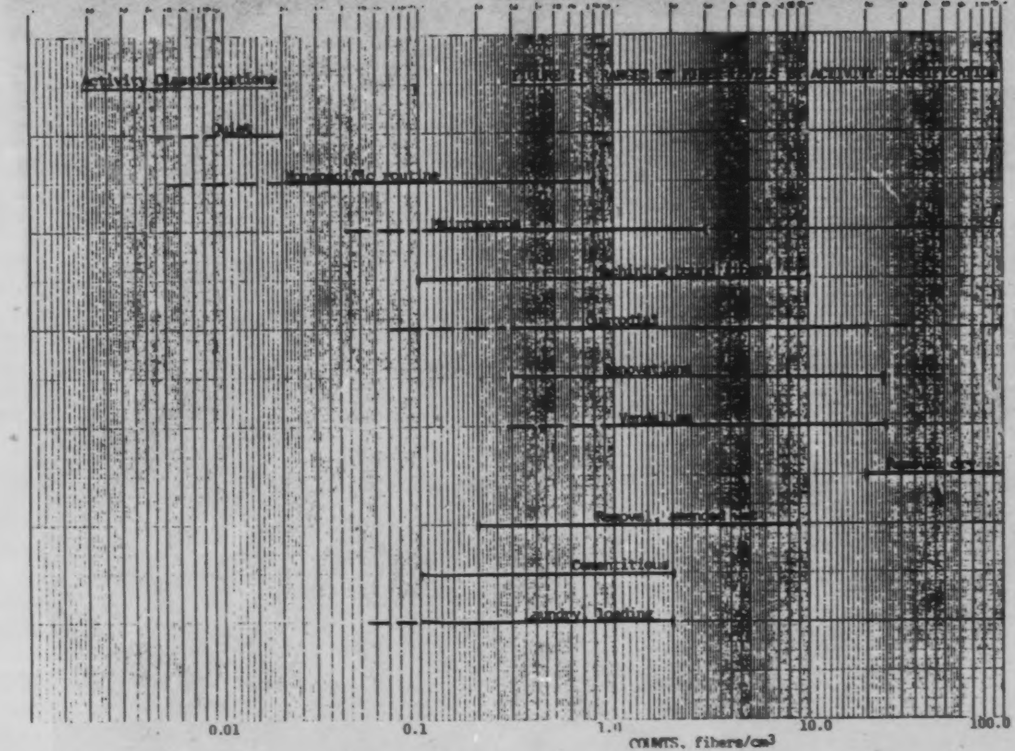

FIGURE 1. RANGES OF FIBER LEVELS BY ACTIVITY CLASSIFICATION

TABLE 2: ASBESTOS EXPOSURE LIMITS (OSHA,NIOSH)

	Fibers per cubic centimeter	
	Time weighted average (t.w.a.)	Ceiling limit
OSHA Original 1972[13]	5.0	10.0
OSHA Present 1976[13,14]	2.0	10.0
OSHA Proposed 1975[15]	0.5	5.0
NIOSH Revised 1977[16]	0.1	0.5

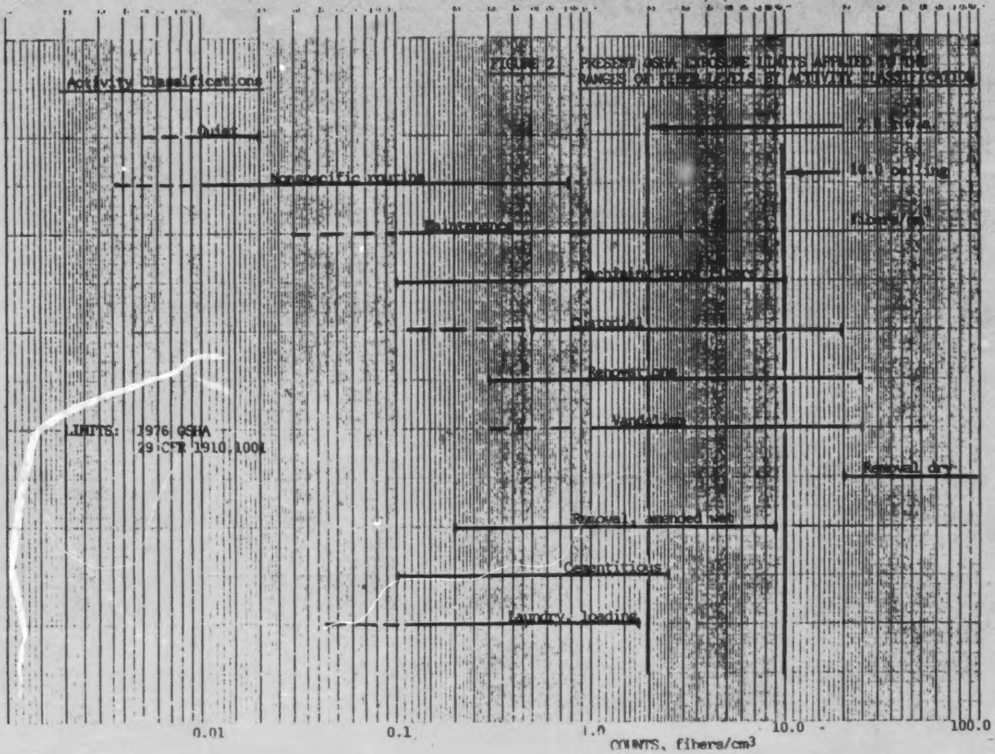

FIGURE 2 PRESENT OSHA EXPOSURE LIMITS APPLIED TO THE RANGES OF FIBER LEVELS BY ACTIVITY CLASSIFICATION

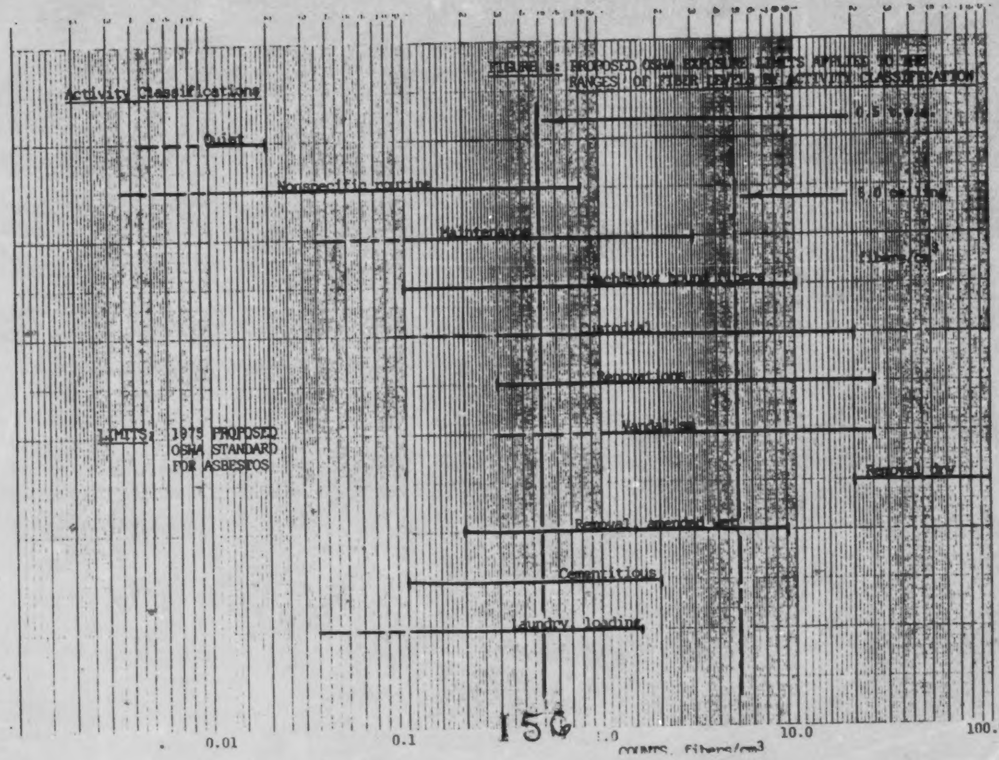

FIGURE 8: PROPOSED OSHA EXPOSURE LIMITS APPLIED TO THE RANGES OF FIBER LEVELS BY ACTIVITY CLASSIFICATION

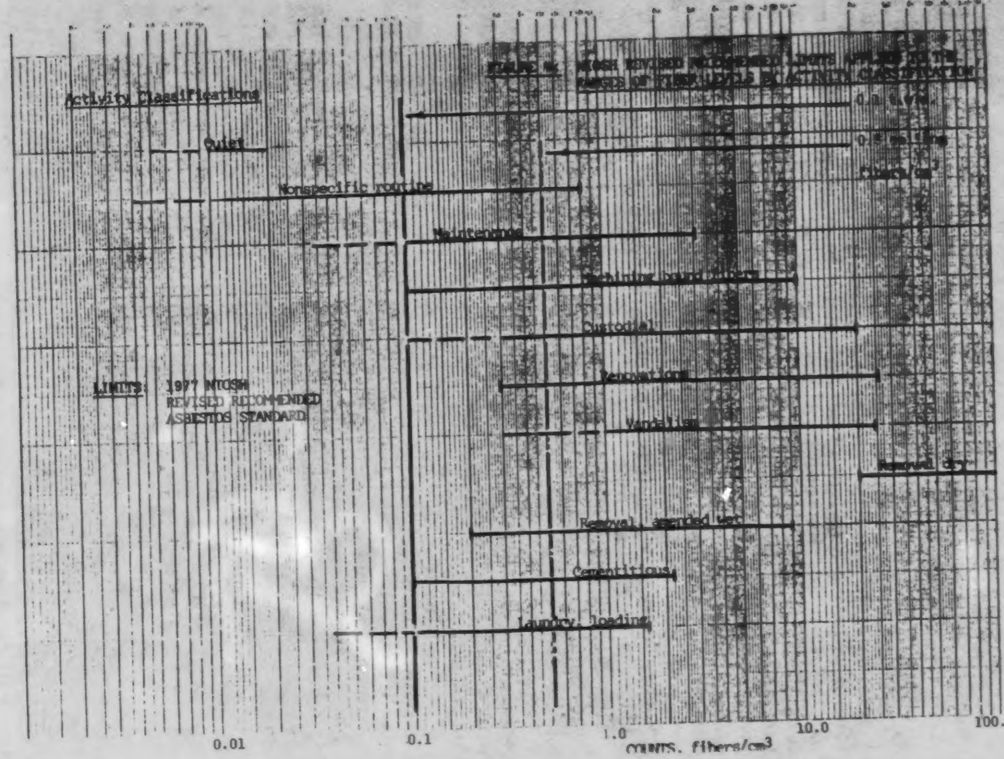

FIGURE [illegible]. NIOSH REVISED RECOMMENDED LIMITS APPLIED TO THE RANGES OF FIBER LEVELS BY ACTIVITY CLASSIFICATION

Dr. **Sawyer**. Mr. Chairman, I am Dr. Robert Sawyer. I am the head of the preventive and occupational medicine section at the Yale Health Service at Yale University. I am board certified in preventive medicine and a fellow of the American Academy of Preventive Medicine. What I would like to discuss today, this is a brief outline of the first part of the presentation, to give you some idea of what asbestos looks like; talk about fiber characteristics that are relevant to this question here today; discuss fiber sources, asbestos fiber sources within structures; then present to you contamination data that we have accumulated over a period of some years—the contamination data represents what we have seen with one of the techniques of measurement of asbestos within structures and within schools—and then attempt to compare what we have seen within structures to our knowledge as far as epidemiology goes, in other words, what levels of contamination may possibly be considered to be hazardous.

This is a photomicrograph, approximately 50 magnifications, of a large bundle of chrysotile asbestos. This just briefly outlines the asbestos. It is not a totally adequate word. It is like the word "gem" in referring to precious stones. The asbestiform minerals are really types or certain expressions of various types of rocks that have formed and fibers formed under various conditions appropriate to the formation.

It is important for anyone dealing with this problem to have some understanding of why the asbestos fiber is a problem besides the fact that it is indeed a carcinogen, able to cause cancer, and also a co-carcinogen, able to act with other agents in causing cancer.

No. 1, the fibers are durable, they resist environmental and degradation within the body. This is important because if you put asbestos fibers into a building they are going to stay there and not degrade. If the building lasts 100 years the asbestos fiber will be there 100 years and still be an asbestos fiber. It also resists degradation in the body. The body has a difficult time in clearing and getting rid of the asbestos fiber, and as we know from a lot of epidemiologic information in handling the asbestos fiber diseases occur, either asbestosis or various forms of malignancies. There is something inadequate in our cells in handling asbestos fibers. Indeed, I will stress this later, the human being does not act as a passage mechanism for fibers but should be viewed as a sequestering device. If a human faces continuous, even low-level exposures to asbestos fibers the human will tend to sequester the fibers and the effect will be dose-cumulative rather than instantaneous.

The fibers have aerodynamic capabilities. They exhibit a very low settling velocity, they can float in the fluid of air. They can also participate in reentrainment cycles. Because of their aerodynamic capability, a fallen fiber can be kicked back up into the air, attaining the height of the respiratory mechanism and we can breathe it again. Just having the fallout of a ceiling or a wall does not mean you are rid of the problem. It has inertia, it enjoys relative containment within the structure. If you knock fibers loose, they do not go off into the atmosphere immediately. It takes energy to push them around.

This is a rough curve showing you the fact that asbestos fibers can hang up in the air when you knock them loose. This is from a friable ceiling. If you notice, the time is in hours in the bottom paragraph there. From such information we can develop a family of curves and this diagram—I will not bore you with the details of it—the dimensions on it are fiber length and fiber diameter and also settling time.

What this boils down to is the fact that if we have fibers that are 5 microns long and one micron in width, these are extremely common in any of the materials we are discussing, it will take about 4 hours for fiber that size to settle to the ground if it is dislodged from a 3-meter high ceiling, with a 9-foot ceiling. If you knock fiber loose it will take 4 hours in quiet air. The smaller the fiber gets, especially the smaller the diameter or width of it, you can see the bottom, one micron, takes 80 hours to settle from a ceiling.

Where do we find asbestos materials in structures?

Here I wish to state that we are not talking about just sprayed materials; we are talking about a lot of different types of asbestos-containing materials. It is widespread, it is in large amounts, and this has been covered by other speakers.

The fiber released from materials into the used environment of a school building will depend upon what material is encasing the fibers. Even very hard materials such as asbestos concrete will release fibers at a very high rate if you put enough energy into the system. If you take a circular saw and cut through any material that contains asbestos you are going to dump a lot of it into the atmosphere. The friable form, which means you can break it with pressure of a hand, which usually means it was spray-applied, is the most effective, by far the most effective way to get fibers into the atmosphere, although we should not just restrict our thinking to this.

This comes into the situations where one might have renovation or repairs in a school building, even with fire-containing materials. But the friable one is the form we should address ourselves to. This diagram schematically represents the various sources of asbestos materials within a building or school structure.

You can get it from friable ceiling material, spackling and maintenance; it can be contaminated from the community. If someone is tearing down a building next to a school, the school can be contaminated with the asbestos. Sanding or cutting, reentrainment of fibers, there is a number of ways to get asbestos fibers into a structure. These are some slides of common usage.

Structural steel deforms at very low temperatures in a fire, around 8 or 900 degrees it starts to deform. In the case of a skyscraper or large building, this can seriously compromise the integrity of the structure. This is why fire-retardant material is put on structural steel. It was a great engineering and economic advance in the 1950s when Underwriter Laboratory approval was given for using sprayed asbestos versus concrete to encase structural steel, with obvious great effect on the building structures. This is 20 percent chrysotile sprayed on structural members in a school building.

This is a happy college scene at Yale University of the architecture students busy at their work. The entire overhead surface of that room is very friable, 20 percent chrysotile asbestos. We had an Olympic Israeli basketball player with an Afro haircut who would leave a trail of fibers when he walked down the room there.

Chairman PERKINS. Let me make an announcement.

When the committee adjourns today, we are going to recess to meet next Tuesday at 9 a.m., for the continuation of the hearings.

Go ahead.

Dr. SAWYER. Okay. This is a good example of a ceiling that is failing because of installation, or adhesion failing. It is about 15 years old.

This is a ceiling that was installed in a school with a pretty good installation job. It has suffered extensive contact damage from students.

This is a hung ceiling system, you can notice the debris on the top of the panel from fallout from the material behind the huge ceiling system.

These books are from a university library with a sprayed 15 percent chrysotile asbestos ceiling that, because of degradation of the adhesives, the material has disintegrated and fallen on top of the books. When opened or taken from the shelves, of course you can see later we have documented aerosolization and fiber dissemination from these sources. Luckily these were at Yale University and were not opened that often.

Besides doing surveilance work of actual asbestos exposure in various situations, we have performed experiments reenacting various scenarious to try to get some idea of the potential asbestos exposure with the instructors. This was in a building with sprayed asbestos ceilings. You can see the air tanks, hose-sprayed respirators. That is an experimental space.

We did removal experiments involving very heavy contamination, and there I think that is myself and I am wearing a respirator. The small white device hanging over my left shoulder is a filter holder that is sampling the air near my respirator. It is breathing what I would be breathing. These are union carpenters installing a partition to get some idea of exposure levels. The sampling devices we used can be seen on the lower left hip.

We also did laundry experiments, things of this sort.

From this work a concept has evolved; from such asbestos surfaces, fibers can enter the fiber of a structure in three general modes. Number 1 is fallout, number 2 is contact, number 3 is reentrainment, or secondary dispersal. Entry of fibers into the environment by fallout is at very low level. In the case of friable materials, this can amount to a significant release of fibers over a period of time. It is very low level but it is persistent. It can worsen with time. Low harmonics in the building, building vibration, seismic effects, anything like this can increase such dispersal.

Impact is a very significant one. As will be shown, you can get very high level of exposure, indeed exceeding even industrial standards, if you engage in impact release of fibers within school buildings. Secondary dispersal or reentrainment of falling fibers is also a significant source.

This slide is simply to give you some idea of our approach to the documentation of what we are looking at. In this regard, and I will get to this, we have used not sublight microscopy or electromicroscopy, but we have used the electrical microscope technique of OSHA and NIOSH; we have used the industrial standardized measurement technique in spite of its drawbacks and restrictions to do this work, because we want to compare it to some existing standards. I will get into that.

If you notice on the left all the different activities, quiet, routine, maintenance work, custodial, renovations, vandalism by students, removal dry, removal wet and so forth, and all different specific activities that we have accumulated data on. For your convenience, what I have done is present this data on a semi-logarithmic plot to give you some idea of the variation and also the scope and intensity of fiber release that we have documented within structure and within school buildings.

Running from left to right, these are ranges of fiber counts obtained by the optical microscope method. The various lines represent simply different things that people are doing at the time that the fibers were released. As expected, far off to the right, near 100 fibers per cc, which is 50 times the present industrial standard, we find dry removal of asbestos in large quantities, persons entering a room and simply scraping the material from the ceiling.

Far on the left we see just simple quiet activity. Here again I am taking some freedom with our experimental techniques. We feel that this technique does not really function below 0.1 fibers per cc.

The method of measurement is inadequate to really do good research work looking for asbestos fibers, the optical microscopy technique, number one, does not count asbestos, it simply counts particles with a certain aspect ratio and size.

Number two, because of the technicalities involved in the mechanisms, the filters, the mathematics, the filtering system really stops functioning around 0.5 cc. It is like using the automobile speedometer to measure the speed of a turtle; you get down off the scale, you cannot get a very good reading. On the other hand, it falls down when you get above 100 fibers per cc because of high concentrations on the filter.

What I would like to do now, and here again one of my purposes is to approach the very significant problem of: Is what we are finding within structures, within school buildings, is there a problem, is there a hazard in what we are seeing here? It is a very difficult question to approach with honesty.

We have a number of techniques for measuring asbestos concentrations. The only standardized technique is called optical microscope microscopy using a light microscope with its limitations of resolution, using a system that is nonspecific for asbestos, that is really inadequate for measuring low levels of concentration.

On the other hand, we have sublight microscopy, electron microscopy, both scanning and transmission, where transmission electron microscopy is indeed, as practiced at such institutions as Mt. Sinai in New York or Bethel or other places, is a definitive way of measuring asbestos burden within the atmosphere. But there is no standardization in these systems. Each laboratory uses a different technique of sample preparation and also of analysis, and indeed, one is hard put to understand the results from various laboratories.

In the study by the EPA of 10 such laboratories, there was absolutely no agreement between laboratories in examining the same filters. It is a truly experimental technique. For this reason I have restricted myself, regrettably, to the optical technique with all its drawbacks.

Also, in discussing schools, what I am going to do to just get an idea of are we in trouble, I am going to use the William Steiger act production of OSHA, the Occupational Safety and Health Adminisstration, and the National Institute of Occupational Safety and Health and look at their opinions, understanding fully that these are indeed conservative because they are based in great part on the economic considerations of the cost of asbestos control. Nevertheless, let us look and compare these two things, understanding that these are very conservative estimates and hazards.

The original 1972 exposure limit, time-weigthed average was 5 fibers per cc, with a 10-fiber per cc ceiling limit. This means you can average out at 5 but at no time are you to exceed 10 fibers.

In the 1972 legislation was placed the limit to become effective in 1976. It said we are going to go with 5 but 4 years from now we are going to drop you to 2, to give industry a chance to bring about the engineering changes necessary for this control.

In the meantime, in the 1960s, 1970s, epidemiologic information from body-counting, from deaths, and illness, were accumulating so rapidly that in the Federal Register there is OSHA-proposed, a proposed change to 1920.1001, saying that the 5 and 2 are inadequate for protection, that 0.5 and 5 should be the new standards.

In addition to this, NIOSH has recommended on the basis of further epidemiologic information, here I will not bore you with the details, but that this was a good distillate of epidemologic knowledge, that indeed the .5 is inadequate and 0.1 and .5 should be the limits of exposure in industry.

If you remember, I mentioned that those of us who deal with the system of optical miscroscopy feel that 0.1 is the bottom limit. The system runs out of steam there. It stops being useful. What they are really saying is that we want exposure of employees limited to the limits of our ability to measure such exposure.

If we take our data that we put on semi-log plots and begin to apply these criteria, this is the first one, the 1972. Again we have ranges of fiber exposure and superimposed upon this in vertical lines is the supposed limits to insure safety of employees in industrial situations, based on economic considerations. These are conservative estimates.

Indeed, we see that some of the things that people can engage in in buildings, within structures, within schools, indeed can exceed these limits.

This is 1976, became effective in July 1976, and was on the books in 1972. It begins to encroach even further. This is the 1975 proposed OSHA legislation, already within the Federal Register. We begin to see that there is a lot of activities that you can do within a building that begin to get in this ballpark.

This is the NIOSH, 0.1 to 0.5 limitation which intersects with nonspecific routine activity, maintenance, everything except being quiet in the building. We have yet in the hundreds of schools that I have been in, have yet to see quiet activity as an average activity level.

So going back, I do not wish to make this a specific statement of reality here because the data up there is based on a lot of assumptions, on a lot of inadequate technology. But it does represent perhaps an approximation, an approximate answer to the question: Is there a hazard in school buildings? I think there is.

I think such a conclusion is unavoidable in light of this information. Again, not being specific about it, but I think that there is a hazard, under certain conditions a potential hazard to people within the used environment and structures.

I would like to briefly run through what can be done about this. Usually there is recognition of a problem, proper sequence should be the friable of material, as we explained, the only really effective way to get fibers to people, probably, in the architectural expressions that we have viewed is with the friable spray-applied material. It does not have to be spray-applied as long as it is friable.

If you can break a part and it contains asbestos, you are in trouble. Material analysis, I totally agree with Dr. Rall that this is a very weak point, finding out in this hodge-podge, this tremendous heterogeneous mix that we find in sprayed material, are there asbestos fibers in it? Hazard estimation. Obviously, well-applied cementitious, asbestos-containing material behind a tack hung ceiling system is probably of no specific hazard whatsoever. However, visible accessible exposed damaged material should be viewed with some great concern. You can either leave it there, you can keep it under various conditions, or you can remove the material.

What does all this mean? Retention, no action, do not do anything about it, put up barrier systems to effectively remove the asbestos material from the used environment of the structure.

Now the ceiling systems, new walls, things like this, shutting down areas of the building, encapsulation, using chemical agents to coat, to adequately coat and seal off and encapsulate the material, to protect it not only from fallout but from impact contact. Removal, dry, wet and amended wet. The regulations, by the way, since we are now talking about contracting work, the various regulations of OSHA and EPA, 29 CFR 1001.1004 apply in all this renovation. These are just outlines of the EPA regulations, what they cover; the OSHA requirements, the present OSHA requirements for such work. This is applying the water to a sprayed asbestos ceiling.

We have developed some techniques using amended water. This contains a surfactant or wetting agent, and you can see the tremendous increase in effectiveness in dropping—if you look under the mean there it goes from 80 to 23 to 8, as you go from dry to untreated water to amended water.

This is an effective application of amended water with sprayed material. You can see the small droplets of water leaving it, yet there is no excess runoff or great slop to this whole system. It is extremely effective.

As Dr. Nicholson pointed out, we have achieved, during removal, fiber levels lower than the present industrial standards requiring no protection, removal of this material, with using these techniques properly.

This is simply how to get rid of this stuff. This is an application of an encapsulating agent, a bridging, butyl polymer, that coats the asbestos material, just to give you some idea of what this involves. Again the respirator the worker is wearing is not the protective material that he is putting on but also, since this does represent contact, you are putting energy into the fiber system, you will knock some fibers loose. We have documented that also.

This is a slide showing the effect of changes in techniques of custodial work. If you notice, on the left, four fibers per cc were achieved with dry dusting in a building. That is twice the present industrial standard: four fibers per cc by the optomicroscopy techniques.

Using chemical claws and wet methods we were able to knock this down to 0.2. It is not perfect, but it is something to really answer perhaps the question of how rapidly we have to do things. Here you can do something to reduce exposures while you are waiting for a definitive solution.

So what have I been talking about here? We are talking about a carcinogen and a potent co-carcinogen, especially with cigarette smoking, and perhaps with other agents. It has aerodynamic capabilities and its effects are persistent.

The disease progression exhibits a long latency period. In all, the great ignorance I am exhibiting here as a physician is due probably to the latency period involved in this disease. We are now engaged in nothing short of body counting, looking at the effects of asbestos exposure.

What I think we should be addressing ourselves to is to decrease our ability in the future to count bodies from this exposure by using the technology and information that we now possess and try to prevent the bodies from occurring from this disease.

It is a progressive system. The human sequesters the fibers. The disease process is progressive. In other words, you can remove the person from the exposure and the disease will progress nonetheless because of the durability and persistence and biologic activity that will continue within the body. It does not take constant exposure to get either asbestosis or the malignancies involved with the asbestos exposure.

Chairman PERKINS. How much exposure if it doesn't take constant?

Dr. SAWYER. Unfortunately, we are ignorant in that area. I do not believe—and I think there is enough epidemiologic information available to state with emphasis that there has been no safe level of asbestos exposure yet demonstrated by the techniques available to us at the present time.

We can tell you what is dangerous, but we are ignorant, we cannot see what is a safe level. Through my thinking of this and my concern of this, I am left with the opinion that all unnecessary exposure to asbestos should be eliminated and all essential or necessary or unavoidable exposure should be minimized. That is not too exact, but there is where my mind is right now.

One, I do not believe in a threshold concept.

Two, asbestos is now a ubiquitous, essential material in any industrial society. World production in 1900 of all time probably was 100 tons accumulated through all time. Now it is approaching 5 million tons a year on a world scale. It is a highly effective material. I am very pro-asbestos.

I think engineering-wise, economically, medically, it is good for society. However, I believe that there are many persons afflicted with asbestos-related illnesses because of our lack of understanding and wisdom and knowledge of the other side of the coin and its use should be restricted, controlled and understood more than anything.

Chairman **Perkins**. You are telling us that any exposure should be eliminated as soon as possible?

Dr. **Sawyer**. That is a very loaded question. I feel that any exposure should be eliminated, or if it is unavoidable, then minimized. And, yes, I guess I would have to say as soon as feasible. All things are possible, within reason.

One of the things that I am extremely concerned over is the panic, the overreaction to the situation, that I don't think is reasonable with what we know at the present time, and I am not speaking of the Howell township experience which is ludicrous, comical, almost.

The physician involved attributed an acute illness to the exposure to asbestos—apparently he had not done his homework. The community reaction to this, the lack of guidance supplied to the community, I thought, was inadequate.

I am not talking about those situations. I am talking about the hard-nosed decisions of saying that we have a building with a known exposure that indeed is somewhat higher than the community levels, what does it all mean? How rapidly should we act?

Mr. **Kildee**. Mr. Chairman?

Chairman **Perkins**. Go ahead.

Mr. **Kildee**. If you had a child in a classroom who had some asbestos release into the air, would you want to keep your child in that classroom?

Dr. **Sawyer**. That is what I am talking about. What is some? How are you measuring it? I am going to get to go on this point on a slide.

Mr. **Kildee**. The question is rather important to us.

Dr. **Sawyer**. Yes.

Mr. **Kildee**. We are not scientists here. We are lawmakers. There is much we don't know.

You say you cannot say with certitude that a certain amount is safe. Now I would like to take this down to the people we are serving. What would you, as a parent, think if you had a child in a classroom where there was some release of asbestos into the ambient air?

Dr. **Sawyer**. Myself or a parent?

Mr. **Kildee**. If you are not a parent, just put yourself in the position of one.

Dr. **Sawyer**. No, I am. In trying to think of myself, how I would react, I hope I would react the same way as I have in many cases. I will not say that because there is some release that I would remove my child from that room, from what I know, speaking as this person.

Mr. KILDEE. That is a rather fundamental question, though, isn't it?

Dr. SAWYER. It is extremely fundamental and I am trying to answer it in as much honesty and give you as much data as I can. You are also emotionally loading the question.

Mr. KILDEE. We cannot separate the feelings of people, or their visceral and their cerebral reaction. It is pretty hard to dichotomize man. We have people out there with children in classrooms and they realize there is some release into the ambient air and no scientist can say that there is a safe level. You won't say that yourself.

Dr. SAWYER. At least I have tried to write of it and raise the question with the inadequacies involved. I am also trying to come up with a reasonable answer to the best of my ability. I am also trying to tell you what we are ignorant about.

Mr. KILDEE. We don't use the word emotional in a denigrative sense. I became emotional about the Vietnam War and at the same time I was rational about the Vietnam War.

I get emotional when people's health is concerned.

Dr. SAWYER. I have empathy for your feelings.

Chairman PERKINS. We want to get the lights on as soon as possible.

Dr. SAWYER. All right.

The host mechanism, we should remember, does sequester fibers. You don't breathe them in and get rid of them right away. The pattern of exposure in schools we have found is extremely variable and intermittent, but in some cases, especially in the cases of vandalism or athletic activity or just capricious activity, can be significant.

Analysis: This is what I was discussing previously. There are two general areas of analysis. One is the identification of asbestos in a school in a bulk sample. You can go up and take a handful out of the ceiling to find out what is in it. This is a very important thing to understand. This is achieved by petrographic microscopy which is a technique of optical crystallography. It is a specialized geologic technique that requires a lot of ability.

Backing this up is X-ray defraction of the material and analyzing the patterns from this. On a very rare occasion electron microscopy has a part. The quantitation of the asbestos released into the environment is done by air sampling with optical microscopy and electron microscopy. These are just techniques used in this.

In my last three slides what I would like to do is to just run through some things that we have seen in schools specifically.

One of the things that we have seen is what we call the OSHA 2-step. As I mentioned, the industrial limit for fiber exposure is 2.0 fibers per cc. This has been used repeatedly in school situations as a criterion for safety within school buildings. Air sampling will be performed by the OSHA method. Counts close to zero will be obtained. That is safe to say under normal climate conditions.

The zero counts will then be compared or very low counts will be compared to the 2.5 fiber cc industrial standards and the school will be declared safe and no action taken.

It is noted that the recommended standard of 0.1, if a school child under normal activity is allowed to breathe this, in an 8-hour period will accumulate in the range of 10 to the 5th fibers, will respire, will breathe air containing 10 to the 5th asbestos fibers.

We feel, and in the work that we have done, that air sampling has a negligible effect on decisionmaking in schools and should not be encouraged or used for the various reasons I have discussed.

In schools we have discussed the fallout. Constant re-entrainment is how fibers get into the atmosphere. We have seen both active and passive surveys of school systems. The passive surveys, we feel, have failed to describe the conditions within the schools. We have discussed air sampling.

As Dr. Rall has pointed out, in analysis areas, areas in analysis of asbestos within school buildings, we have seen, even with State laboratories, in some schools asbestos has been stated to be present when it was not and the school spent some $20,000 in removing ceilings that contained cellulose instead of chrysotile asbestos.

On the other hand, we have seen numerous examples of analysis done on ceiling material that has failed to show asbestos. One State laboratory produced information that less than 1 percent or a trace of asbestos was present in a ceiling sample when in reality the ceiling contained 80 percent chrysotile asbestos.

So there is a lack of depth in the United States of competent analysis for this. By the way, the American Industrial Hygiene Association qualification of laboratories for asbestos analysis does not mean they know how to do bulk analysis. That is for air counting only.

Health department function we have found varies greatly. In some instances the health department has reacted responsibly and with a great deal of effectiveness. However, other health departments have not functioned in such ways and they should not be relied upon.

In a northeastern State the American Cancer Society gave an award, an annual award, to a newspaper that attacked the health department for its behavior in handling problems with asbestos.

So in this case the American Cancer Society did not give an award to the State health department but to the newspaper that vilified it.

In school boards we have seen all sort of actions, mainly they need information and education in this matter.

As far as employee protection and remedial operations, we have witnessed some laxity on the part of many contractors in using the EPA and OSHA regulations. These are all various items cited in the paper that I have brought as my testimony.

We have seen a number of asbestos hustles, the most flagrant of which was again in a northeastern State involving the State Board of Education which is presently under investigation by the Attorney General in the State for its behavior in this matter.

The State Board of Education recommended an engineer who recommended a consultant to a high school with a tremendous asbestos problem, probably involving half a million dollars. The consultant then recommended a contractor.

The whole thing was broken apart by an investigative reporter who found that the out-of-state consultant was a registered physical therapist and was the son-in-law of the contractor and knew almost nothing about asbestos-related diseases or measurement techniques, but yet had tremendous lists of recommendations from both the engineer and the contractor.

There is big money in this. There is a lot of opportunity for profiteering, and there should be a lot of attention, I feel, given to this aspect of the problem, also.

What to do? I think the failures that we have seen in dealing with this problem in schools involve failure to disseminate a proper amount of information. I would certainly recommend an increasing of awareness nationally with education availability, of consultation, analysis.

I have pointed out that we are very weak nationally on the ability to do competent bulk analysis. As far as air sampling goes, I think we are dealing with a technology that is inadequate in a number of different ways. As far as contractor performance, we need some tightening up to prevent worker exposure whenever remedial action is embarked upon.

Now the lights can be turned on.

Mr. MILLER [presiding]. Mr. Sawyer, thank you for that presentation. I would like to follow up.

Well, first of all, I would like to ask you a question. Are we able or do we measure, from the air samplings that I have read about, are we able to measure fibers less than 5 microns or do we make an attempt to do that?

You talked about concentrations. What about the measurement of individual fibers, especially what you said about the ability to stay airborne for 80 hours?

Dr. SAWYER. Yes. There are two answers to that.

One is the technical power of the standard optical system. Your limits of resolution are, ball park, 1 micron. So you start running out of ability to look at fibers optically at about 1 micron.

Five microns, by the way, a human red cell is about 7 microns, just to give you some frame of reference in this.

With the phase contrast microscope—this is a light microscope—light comes through it and you have optics. It is looked upon as boosted light microscopy because of the phase characteristics of it. You can see particles better fooling around with the phase use of the microscope.

Legally the system is truncated at 5 microns. That is how you do it.

Mr. MILLER. Are we really measuring total exposure when we measure at 5 microns?

Dr. SAWYER. No, you are not. Rall at Mt. Sinai puts the ratio at perhaps 100 to 1. That is, if you measure for every fiber counted by the optical microscopy system, he has stated there are 100 particles less than 5 microns in length of potential pathologic significance that are not counted. You are opening a big answer here. That is 1.

Other studies using scanning electron microscopes—Rall uses a transmission electron microscope—have found 5 to 50 versus those not counted. This should raise in your mind a question concerning pathologic significance.

What fiber is dangerous? Once more, we are ignorant. We cannot answer that presently.

Mr. **Miller**. But just as a lay person, would it be fair to suggest that the cumulative effect of the exchange of air with asbestos fibers contained within is greater than the measurement of a fiber of 5 microns? Is there an accumulative effect of the smaller fibers that go with the respiratory exchange of that air?

Dr. **Sawyer**. Yes, true.

Mr. **Miller**. If we are dealing with a substance which you don't recognize a threshold one, that is what I am trying to get at, the pathological effect of that.

Dr. **Sawyer**. Yes. Not only that, but if the final common expression here is a malignancy, is either a bronchogenic carcinoema or a mesothelioma, I think this reaches a point of being an academic question, to dwell on what fiber length is most dangerous.

So, yes, I think the system is inadequate. We are measuring something with the optical microscopy system with its limitation of 5 micron size. We perhaps are not seeing where the action is.

Mr. **Miller**. To come back to your very blunt statement about all that we are doing now is counting bodies——

Dr. **Sawyer**. Yes.

Mr. **Miller**. If I am correct in my interpretation of your answer, it would be fair to say that under the current assessment practices, they will not lead us to full identification of how we stop that body count from taking place in the future because the measurements may be wrong.

Dr. **Sawyer**. Yes. I would agree.

As I mentioned previously, I feel that the technology in this science to answer and approach the questions involved with this significant problem of asbestos-related diseases, that we are dealing with a partially inadequate technology in just measuring the stuff.

If indeed we are to prevent the disease, then I feel that we should not be looking at the diagnostics involved in its end expression, but we should be looking to the environment and trying to measure this carcinogen presently that we are facing.

Mr. **Miller**. It is my understanding that you participated in the measurement of these concentrations in a number of different schools?

Dr. **Sawyer**. Yes.

Mr. **Miller**. And you have also suggested and recommended that certain removal take place in some of those schools.

Mr. Kildee asked you what you would do if some levels were available. Let me follow up on that and ask: Have you measured schools which would have led you to the conclusion that your child should not have continued enrollment at that school?

Dr. **Sawyer**. Yes.

Mr. **Miller**. Are those schools in which you have recommended carrying out the material?

Dr. **Sawyer**. I did not make that decision in most of these schools on the basis of air sampling in those schools. I do not base a great deal of weight upon air sampling.

Mr. **Miller**. You go more to the condition——

Dr. **Sawyer**. I go more toward common sense and what is in the ceiling.

Mr. **Miller**. Combining the two, though, you have dealt with schools where you would prefer that your child not participate in daily activities?

Dr. **Sawyer**. Absolutely. Taking into account that I have spent much time doing optical microscopy of air levels, looking at electron microscopy results in trying to gain some insight into the technology available, which does give us a lot of information, I am not talking it down—I am trying to be accurate in our assessment of its utility—I do not think that air sampling yields much to the decisionmaking process in a given school because of the nature of the fiber, because of the nature of the contamination, because it is aerodynamic and durable, and because we do not have a good method of measurement, and if we do, what in the world does it mean?

If we really could say that there was a certain number of nanograms in the atmosphere or fibers per cc or tons per cubic mile, we still could not tell you if it is dangerous or not specifically and make a number or a line.

Does that—I am trying to——

Mr. **Miller**. You answered the question, but you raised a whole host of other questions. I want to give the members of the committee time, but I think the questions that you raise go directly to our ability to effectively assess the magnitude of the problem and what our response should be.

Earlier we heard testimony that a letter was sent to the governors telling them to do a survey and you are suggesting that even with the best of intentions they may not come up with the right answer in terms of whether or not a situation is healthy or unhealthy for those young children.

But I would like to pursue that with you later, if I might.

Dr. **Sawyer**. Mr. Miller, you have phrased it quite nicely.

Mr. **Miller**. Thank you.

Mr. Weiss?

Dr. **Sawyer**. It is not an easy question, even, to ask, and the answer is even more difficult to perceive from what we know presently. Any of us who have looked at this problem have a sincere and very deep concern about asbestos exposure of children which, I might say, I don't totally medically agree with you on a child being more susceptible because he is growing faster.

I think our concern, and here, again, I have written about children and school exposures in this disease myself because of this concern, because the child, (1) faces a multiplicity of latency periods.

If you are talking about exposing a 50-year old, I am concerned, but if you are talking about exposing a 5-year old in a disease that exhibits a 30-year latency period, then I am really concerned.

Also, this is a co-carcinogen, not only a primary carcinogen. And how many of those children are going to become cigarette smokers?

Also, if you look at schools, you end up with the conclusion that nowhere in the country are more persons and citizens concentrated in one building at any time during an 8-hour period of any day.

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Mr. **Miller**. As the child grows up and smokes, drinks, drinks diet cola and takes the pill, they are in deep trouble, aren't they?

Dr. **Sawyer**. Yes. And the concentration of exposure in schools is pretty high. If there is an exposure, it will be widespread. I think, for these reasons, the latency period, the concentration, our ignorance about co-carcinogen effect, I think the school child deserves attention and indeed our concern.

Mr. **Weiss**. Dr. Sawyer, Dr. Rall suggested earlier that it was very difficult, if not impossible, to undertake any meaningful studies because it is so difficult to follow schoolchildren.

Is it in fact possible to isolate situations which have existed over a period of time in certain localities where you know that the asbestos has been in place for "X" number of years and study the children who attended that school "X" number of years ago? Since such a large number of children have been exposed to sprayed asbestos, it seems that it would be easier to locate large numbers of people and start drawing some control and test models.

Dr. **Sawyer**. I think that the concept of a prospective epidemiologic study following a cohort of children, following a group of children exposed to low levels of asbestos, I think would be a highly efficient way to gain any information with some exceptions.

I believe there have been some school exposures which have indeed been extremely significant with not only respiration but ingestion of asbestos, where the material was actually taken from the school in lunch pails by removing it from the wall, et cetera.

In these cases a prospective study might perhaps be indicated, but I think from the other study that we know of, that we know enough about low level exposure where we don't have to specifically look at a population of school children.

I think in any ball game you go with what you have and hopefully it is enough. I think we know enough epidemiologically about asbestos-related diseases. If we must put our resources somewhere, a prospective study of schoolchildren is not where to put it. That is my feeling.

Mr. **Weiss**. Have you had occasion in the course of your studies to investigate schools which are not in the public school system but the non-public school system, parochial or private schools?

Dr. **Sawyer**. Yes.

Mr. **Weiss**. Have you been able to draw any conclusions as to whether the problem is as broad in those areas?

Dr. **Sawyer**. None whatsoever. The school building usually is a simple architectural expression. Their form follows function. In keeping with this, the original statements that anything put up up until about 1973 and perhaps thereafter was put on under the guise of decoration can contain friable asbestos containing material, whether it is private, public, urban, rural or anything like that, I don't think it makes any difference.

I think the steps should be: One, is there any friable material in the school, and No. 2, does it contain asbestos, and then from there on, common sense.

Mr. **Weiss**. In listening to your presentation I have the vague concern that one could walk away from these hearings with almost any conclusion.

One could conclude that we have the most critical, most urgent problem that this country and schoolchildren face, or one could conclude that it is a problem which is so vague that there is really very little known about it and very little that can even intelligently be done at this point .On the basis of this presentation, I must confess to you, I am left with that question unresolved.

Could you in two brief paragraphs tell us whether in fact you think it is a very critical, urgent problem?

Dr. **Sawyer**. Okay, I will try.

I think that the absolute elimination of any unnecessary exposure is a reasonable stance to take in this problem. The urgency of the situation is the real question and the most difficult one to answer.

It is difficult because to answer it totally or honestly or with any integrity, you have to consider one's life threats and that is what we are really talking about, what toll will this asbestos exposure take, what does it mean to the individual, and what does it mean to the population?

It is a carcinogen. It causes cancer. It is a co-carcinogen. It has a tremendous synergistic effect with other cancer-producing agents such as cigarette smoking. I do not think it is reasonable that a young citizen of this country be exposed to such an agent, period. The urgency of the resolution, I think, should demand some attention to reason, to economic factors, and to the rest of the person's life.

I do not think that panic, and I do not think that sensationalism, in this case, is called for because of the ignorance that we have.

But if the end point is cancer, then I don't think the first part of the question needs any defense. I think something should be done to eliminate exposure. The rapidity with which this is undertaken, that part is a difficult one.

My major concern, when you talk about that part of it, is no longer school children. It becomes the workers engaged in fixing the situation. It also becomes the school child that has to go back in the school.

A case in point, again a ludicrous situation in Howell Township, I feel the workers' exposure, the hazard to the workers engaged in that remedial operation in that tremendously publicized program, the profiteering involved and the worker exposure should have been a much greater concern than the exposure of the schoolchildren for one more year.

When you start talking about abatement procedures, then your attention should shift from the school child, assuming the protection of the building from the cure, and should shift to the exposure of the workers and perhaps even the community in that one New Jersey city.

A vacuum apparatus was used to remove friable asbestos material in a downtown city. Approximately half a ton of asbestos material was taken out of that building and put through a totally inadequate diesel, 500 horsepower diesel-driven vacuum system and blown out into the downtown streets. I don't think that is a reasonable cure for the asbestos.

Mr. **Weiss**. No, but you are not suggesting that there are not appropriate and safe technological ways to do this work, are you?

Dr. **Sawyer**. There are, I think that there are. However, their utilization both through legislation and regulation and through education and knowledge are not being applied yet.

Mr. **Weiss**. Let me give you the specifics of the problem faced by the parents and children of New York City. You will hear testimony from the Executive Director of The New York City Division of School Building. The Board of Education surveyed some 500 schools, and hazardous levels of asbestos were found in 374.

Dr. **Sawyer**. That is incorrect. That statement is. What they found in that situation was that those schools contained asbestos in friable material.

Mr. **Weiss**. Yes.

Dr. **Sawyer**. I am not criticizing you. I am clarifying. It sounded like this was from air sampling and it was not.

Mr. **Weiss**. Yes, friable material.

Two schools were closed down immediately because the situation was so hazardous.

Dr. **Sawyer**. Who is they?

Mr. **Weiss**. The New York City Board of Education. Two schools were closed down because the judgment was that it was physically harmful and medically dangerous for the children to continue to attend those schools.

Dr. **Sawyer**. Yes.

Mr. **Weiss**. Now, the question is: Given the balancing factor of the safety considerations designed for workers for whom you say there is a technologically sound method by which to do the work, how long do the children who attend the other 374 schools where the level of danger probably decreases, so that in fact school No. 1 may not have a serious problem but No. 212 may in fact have the kind of problem that you want to alleviate in three months, what is a reasonable time for the city, and the government, to undertake a remedial program so that the children don't have to return to that same environment the next school year?

Dr. **Sawyer**. I think it is reasonable (1) in such a situation, to try to reduce and minimize the exposure as much as possible. I am not begging the question of how fast do you go. If indeed our premise is to eliminate or minimize exposure, there are interim techniques that could be used to reduce the re-entrainment cycle of fibers.

There are other techniques that can be used as temporary measures, chemical encapsulation, et cetera.

But I come back to the question of what is dangerous or not. You mentioned that schools should——

Mr. **Weiss**. I suppose that at this point you have to tell us again that nobody really knows what in fact is dangerous.

Dr. **Sawyer**. I have to tell you again that nobody really knows. Those of us who are concerned and looking at this problem feel that if such material, again with knowledge that this is not a gas—in other words, looking at the physical characteristics of the asbestos fiber, not trying to think of this but to really attempt to track the fiber dissemination and find out how it is getting into lungs, how it is getting into bodies—it is not a gas. These are particles. They can be contained and controlled. They do act following physical loss. If the material is exposed, accessible, and shows damage, then someone has been exposed. If it is exposed and accessible, then someone will be exposed. I don't think that is tolerable.

Mr. Weiss. Thank you very much.

Dr. Sawyer. That is one end of the scale. If it is inaccessible, not exposed, I think you can hang fire on it. And, again, there is no black and white solution. In some cases, in many cases, there are a combination of techniques that can be a very, very appropriate answer.

Mr. Weiss. Thank you, Doctor.

Dr. Sawyer. You ask very good questions.

Mr. Weiss. Thank you.

Mr. Miller. Mr. Buchanan?

Mr. Buchanan. I don't know anything about medicine, but I once studied economics. If you were to be put in charge of doing what is necessary to protect the maximum possible number of people in the most reasonable as possible way and the earliest possible way in America's schools, you have already started, but I would appreciate you telling me what you would do as a matter of the public actions that could be taken to get at the problem where it is worst and do the most you could in the most reasonable possible way.

Dr. Sawyer. Yes. We have tried to assist the Environmental Protection Agency—that doesn't sound right. It is our trying that I am describing—in recommending reasonable approaches to the programs and to the situation, predominantly with, of course, the medical and technological emphasis, and also because we are interested in preventing cancer, because we are interested in the health of the children, I am extremely interested in the effectiveness and economic effectiveness of such programs.

I do not feel that being a physician isolates me from the world and its realities. If I wish to prevent cancer, I damn well better understand some economics. I think the problem is one that is solvable within our level of sophistication at present.

I think we know enough epidemiologically. I think we know enough technically, even after telling you what is wrong with our systems and how ignorant we are. I think our concern is genuine for the population we are discussing, our children.

I think now it is a political and a social problem of applying the knowledge that we already possess in the absence of panic and with understanding of what we are doing in a reasonable way to eliminate and minimize the exposures.

I feel that the number of school situations that I am really concerned about are not that great. I think if we look for the—I think if we look for the very small percent that is causing the very large percent of the exposures, we are going to do a very good job here.

Mr. Buchanan. Do you think that would be achievable?

Dr. Sawyer. Yes. I think we can do this by looking for friable material, seeing if it contains asbestos, and applying some common sense in hazard evaluation.

If you notice, I am not mentioning air sampling. I think we can know more with the human mind and the eyes than we can with a lot of air sampling.

I think if we look for friable material in schools, see if there is asbestos in it, and then set priorities for abatement or remedial action on the basis of accessibility, evidence of damage, visibility, I think we are going to come 80 percent of the way. The other 20 we can haggle over.

Mr. BUCHANAN. So even without developing the testing techniques that would be necessary to get down to——

Dr. SAWYER. Well, the bulk analysis is a problem. Up to about 2 years ago there was no need to look in this mores of contractors' dreams that they threw up on ceilings and analyze it for asbestos. Technically, it is a very difficult job to do that. We do not presently have a national standard method. We do not have the expertise distributed throughout the country.

If we could clone Drs. Langer and Rohl at Mt. Sinai by 20 people, we could hack it. Right now we cannot do that. It is very, very difficult to do that essential step.

I have seen errors both ways, positive and negative, in analyzing for asbestos. I have seen errors that permit the continued heavy exposure of students and I have seen other areas that have cost the citizenry a lot of dollars unnecessarily.

Mr. BUCHANAN. I am putting that side-by-side with your 80 percent. Is this an essential ingredient, a necessary step in achieving the protection of the 80 percent?

Dr. SAWYER. Yes. It is not air sampling. I am talking about bulk analysis. Is there asbestos in this friable material?

Please appreciate also that I put the sequence as a search for friable material. In No. 2, see if there is asbestos in it. That will save a lot of trouble also, economically.

The other big part of it, as a physician, as a father, as a citizen, I repeat—and we are trying to approach the problem in a reasonable manner, and I think overreaction and panic will defeat things in the long run.

Mr. BUCHANAN. Just for the record, my own reference to economics had to do with not only what is achievable but how you go about protecting the maximum number of children at the earliest possible time within the realm of what is achievable.

Dr. SAWYER. Yes. I think this is achievable. It is certainly within our level of technical sophistication, with the exception that we are going to have to stretch ourselves in the bulk analysis knowledge. We are trying to work on this now by setting up a round robin proficiency system to get everyone in the act that is interested, to make sure their batting average is high enough. That is a fairly simple social and organizational problem.

I repeat, in spite of our inadequacies, in spite of our ignorance, in spite of our technical problems, I think we know enough to move on the problem. And I don't think that the problem is that large to cause a great deal of over-concern, of panic.

I think it can be done in a logical manner if it is organized properly.

Mr. BUCHANAN. Thank you.

Mr. MILLER. Mr. Kildee?

Mr. KILDEE. Thank you, Mr. Chairman.

Doctor, I will rephrase my question somewhat. I know you minimize air sampling in your testimony.

Dr. **Sawyer.** I have not minimized discussing it, but I would like to minimize its use.

Mr. **Kildee.** But you have minimized it. Let me rephrase the question somewhat and I am asking this in a genuine fashion because I am a parent also.

Since you cannot say that there is a safe level of asbestos in the air, if a parent had a child in a classroom with some release of this asbestos into the ambient air, would that parent be prudent in demanding that the situation be corrected immediately or that the child be removed from the classroom?

Dr. **Sawyer.** No. I do not think the parent would be prudent in doing so.

Mr. **Kildee.** The parent would be imprudent in doing so?

Dr. **Sawyer.** Yes.

Mr. **Kildee.** Thank you very much, Doctor.

Mr. **Miller.** Thank you very much, Doctor, for your testimony this morning. I think we may have some questions we would like to pose to you in writing with regard to that cross between technology and common sense, since it looks like we might foot the bill for what the result is.

Next, because of a time problem we are going to rearrange the appearances here. We will hear next from the panel representing some of the industries here with Dr. James Leineweber, Vice President and Technical Director of Sciences, Johns-Manville Corporation; Mr. Herbert Levine, President, Spray Craft Corporation, and Mr. Joseph Mohen, American Energy Products Corporation.

STATEMENTS OF DR. JAMES LEINEWEBER, VICE PRESIDENT AND TECHNICAL DIRECTOR OF SCIENCES, JOHNS-MANVILLE CORPORATION; HERBERT LEVINE, PRESIDENT, SPRAY CRAFT CORPORATION; JOSEPH MOHEN, AMERICAN ENERGY PRODUCTS CORPORATION; RICHARD CARTER, MANAGER, GOVERNMENT AFFAIRS (HEALTH, SAFETY & ENVIRONMENT DEPARTMENT), AND JOHN S. AUTRY, DIRECTOR OF PUBLIC AFFAIRS

STATEMENT OF DR. JAMES LIENEWEBER, VICE PRESIDENT AND TECHNICAL DIRECTOR OF SCIENCES, JOHNS-MANVILLE CORP.

Dr. **Leineweber.** Mr. Chairman, I would like to introduce myself as Dr. James Leineweber, Technical Director of Sciences for the Johns-Manville Corporation which is headquartered in Denver, Colorado.

With me this morning are Mr. Richard Carter who is Manager for our Environmental, Health and Safety Department, and also Mr. John Autry who is Director of Public Affairs in our Washington office.

Mr. **Miller.** Your testimony will be entered in the record in its entirety. The degree to which you would feel comfortable summarizing we would appreciate because we are getting backed up here with a lot of people waiting to testify.

Dr. **Leineweber.** I would like to summarize and I would like to add some things that are not within the testimony.

For much of the past year, Johns-Manville has been working closely in a cooperative effort with representatives of the Environmental Protection Agency and the Environmental Defense Fund to explore and evaluate concerns which arose relating to the possible existence of a health hazard from the presence of asbestos-containing sprayed-on ceiling materials in school buildings.

It is entirely consistent with the common goals we share of protecting the environment that we voluntarily undertake cooperative endeavors with government agencies and environmental interest groups.

In past years we have repeatedly and voluntarily assisted regulatory authorities in their efforts to investigate potential health hazards. Such cooperative efforts constitute an important ingredient in our concept of corporate responsibility with respect to health, safety, and environmental matters.

When concerns relating to the existence of asbestos-containing sprayed-on materials in schools first arose, Johns-Manville commenced an investigation in order to obtain an understanding of the exact nature and magnitude of the problem. We commenced this investigation because of our position in the asbestos industry.

As many of you know, Johns-Manville is the largest producer of asbestos and asbestos-containing products in the free world. However, I should point out that Johns-Manville never commercially marketed an asbestos-containing spray coating. Since many diverse groups look to us for information and guidance with respect to appropriate versus inappropriate uses of asbestos, potential health hazards associated with asbestos, and means of minimizing these hazards, we felt it was incumbent upon us to conduct an investigation to determine the extent to which the existence of these materials posed a potential health hazard.

The health hazard risk assessment portion of our investigation was undertaken by Dr. Paul Kotin, Senior Vice President, Health, Safety and Environment for Johns-Manville Corporation. Dr. Kotin unfortunately cannot be here today due to a prior commitment. However, he has prepared a written statement for the subcommittee which briefly sumarizes his conclusions. That statement has been attached to my written testimony.

[The statement submitted by Dr. Leineweber follows:]

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TESTIMONY OF JAMES P. LEINEWEBER, PH.D.
HOUSE OF REPRESENTATIVES
COMMITTEE ON EDUCATION AND LABOR
SUBCOMMITTEE ON ELEMENTARY, SECONDARY,
AND VOCATIONAL EDUCATION

JANUARY 8, 1979

Mr. Chairman, Members of the Subcommittee:

My name is Dr. James P. Leineweber. I am Technical Director--Science in the Health, Safety & Environment Department of Johns-Manville Corporation, headquartered in Denver, Colorado. With me this morning are: Richard Carter, Manager, Government Affairs (Health, Safety & Environment Department), and John S. Autry, Director of Public Affairs.

We are pleased to be invited to participate in this hearing on the possible hazards associated with the presence of asbestos in schools.

For much of the past year, Johns-Manville has worked closely in a cooperative effort with representatives of the Environmental Protection Agency and the Environmental Defense Fund to explore and evaluate concerns which arose relating to the possible existence of a health hazard from the presence of asbestos-containing sprayed-on ceiling materials in school buildings.

It is entirely consistent with the common goals we share of protecting the environment that we voluntarily undertake cooperative endeavors with government agencies and environmental interest groups. In past years, we have repeatedly and voluntarily assisted regulatory authorities in their efforts to investigate potential health hazards. Such cooperative efforts constitute an important ingredient in our concept of corporate responsibility with respect to health, safety, and environmental matters.

When concerns relating to the existence of asbestos-containing sprayed-on ceiling materials in schools first arose, Johns-Manville commenced an investigation in order to obtain an understanding of the exact nature and magnitude of the problem. We commenced this investigation because of our position in the asbestos industry. As many of you may know, Johns-Manville is the largest producer of asbestos and asbestos-containing products in the free world. However, I should point out that Johns-Manville never commercially marketed an asbestos-containing ceiling material for spray-on application. Since many diverse groups look to us for information and guidance with respect to appropriate versus inappropriate uses of asbestos, potential health hazards associated with asbestos and means of minimizing these hazards, we felt it was incumbent upon us to conduct an investigation to determine the extent to which the existence of these materials posed a health hazard.

The health hazard risk assessment portion of our investigation was undertaken by Dr. Paul Kotin, Senior Vice President, Health, Safety & Environment for Johns-Manville Corporation. Dr. Kotin unfortunately cannot be here today due to a prior commitment. However, he has prepared a written statement for the Subcommittee which briefly summarizes his conclusions. That statement has been attached to my written testimony.

As you are all probably aware, the Environmental Defense Fund filed a petition with the Environmental Protection Agency on December 21, in which EDF requested that EPA "require the manufacturers and processors of such fiber to take appropriate corrective action to eliminate the emission of asbestos fibers from surfaces which have been sprayed with such materials."

It should be noted that EPA sited Sections 6(a)(3), 6(a)(5), and 6(a)(7) of the Toxic Substances Control Act as the authority for such EPA action. However, the Act only authorizes the EPA Administrator to take such action if he "finds that there is a reasonable basis to conclude that the...use...of a chemical substance or mixture...presents or will present an unreasonable risk of injury to health or the environment." (emphasis added)

We believe EPA cannot and should not take the action requested by EPA as there is no evidence to indicate that the existence of the products in question 'presents or will present an unreasonable risk of injury to health or the environment."

As Dr. Paul Kotin states on page 2 of his written statement:

> "Because of my considerable knowledge and experience with regard to health hazards associated with asbestos, I am convinced that although, based on current knowledge, asbestos-containing spray materials in school buildings represent an inappropriate use of asbestos, no evidence exists to indicate that the presence of these materials poses a health hazard to anyone."

Thereafter, Dr. Kotin elaborates on his reasons for reaching that conclusion. I urge you to read his statement and I will be glad to attempt to answer any questions which you may have regarding his statement or obtain a detailed answer from Dr. Kotin.

After previously reaching this conclusion regarding the lack of any evidence to indicate the existence of a health hazard, we still decided to voluntarily assist EPA in its investigation of this matter when it was brought to their attention early last spring by the Environmental Defense Fund.

After consideration of the matter, EPA decided to commence the preparation of a voluntary action program to provide the nation's school districts with technical and analytical assistance in dealing with sprayed asbestos materials in schools. We initially supported this effort by EPA and still

of our knowledge, EPA has devoted a

considerable effort in this regard.

One might ask why we would support and even assist EPA in such an endeavor when we had already concluded that the existence of these materials do not pose a health hazard and Johns-Manville never commercially marketed such products.

We supported this EPA effort then and support it now for one very sensible reason. By early spring of 1978, when EDF requested that EPA take action in this matter, the existence of these asbestos materials in school buildings had already been well publicized and many school districts had already commenced ceiling renovation activities. At the same time, there was reason to believe that school districts were instituting renovation activities, including the replacement of ceilings, without the benefit of accurate technical and analytical information. Furthermore, some of this work was being performed by contractors who were not sufficiently knowledgeable as to appropriate renovation actions or in the fundamentals of proper controls to avoid the unnecessary creation of airborne concentrations of asbestos fiber.

It was our considered opinion at the time that regardless of whether EPA took action or not, a certain number of school districts were so concerned, or were under such pressure, that renovation action would be undertaken in any event. Therefore, if renovation action was going to be undertaken by school districts regardless of the actual existence of a health hazard, we felt then, and still feel now, that it is worthwhile to provide the nation's school districts with the necessary technical and analytical assistance so that they can make an informed decision. Therefore, we support EPA's efforts to institute a voluntary action program and will continue to assist them in this regard.

The benefits are obvious. For example, those who have studied the situation all seem to agree that the mere existence of asbestos-containing ceiling materials in a school building does not necessarily mean that any form of corrective action is warranted. As I will discuss in more detail later, if the ceiling material was applied properly, does not show signs of wear or flaking, and is not subjected to malicious or accidental damage, then no renovation action need be undertaken. We are concerned that some school districts may decide to undertake renovation action and spend considerable sums of money which may not be warranted.

As another example of the reasons for our concern, if a school district decides to replace the ceiling material, it is important that the school district and the contractor it retains be fully informed as to the proper techniques to perform this work, so as to minimize asbestos contamination during renovation.

In this regard, we endorse EPA's Guidance Document entitled, "Sprayed Asbestos-Containing Materials in Buildings," which was published in March, 1978.

In conclusion, we felt that the voluntary action program by EPA and cooperation by Johns-Manville would provide accurate technical information and therefore avoid unnecessary actions and expenditures and further avoid the possible creation of needless exposures to asbestos which otherwise might occur.

With this as background, I would now like to provide a summary of the findings and conclusions of Johns-Manville's task force on asbestos-containing sprayed materials, which I headed.

BACKGROUND INFORMATION

Asbestos-containing coatings were widely used for fireproofing, acoustical, and decorative applications from approximately 1950 through the early 1970's. Since the turn of the century, many building codes have required that the steel beams and columns in high rise buildings be protected with a suitable fire resistant coating. Because of their very low mass, asbestos-containing spray-on coatings were used extensively to satisfy this requirement. These products permitted the construction of taller buildings with an added margin of safety for the occupants. Their unique properties also led to their extensive use as acoustical and decorative ceiling coatings. At the end of the 1960's and in the early 1970's, the Federal Government as well as the asbestos industry became aware of the fact that the use of these asbestos-containing spray-on coatings represented a possible hazard to the workmen responsible for their application and a release of asbestos fibers into the ambient air. This awareness led to an active search for substitute materials, and the ultimate banning of their use (1973) by the EPA.

The main questions which must be addressed at the present time are: WHAT IS THE RISK PRESENTED BY THESE SPRAY-ON COATINGS TO THE PRESENT OCCUPANTS OF THE BUILDINGS, AND WHAT CAN BE DONE TO ALLEVIATE ANY HAZARD, REAL OR PERCEIVED?

In answer to the first portion of this question, we submit the appended statement of Paul Kotin, M.D., Senior Vice President, Health, Safety and Environment for the Johns-Manville Corporation. His conclusion is that, "...no evidence exists to indicate that the presence of these materials poses a health hazard to anyone."

If, on the other hand, school districts desire to make renovations regardless of the existence of a health hazard, it becomes necessary to formulate a plan to minimize or eliminate the potential release of asbestos during these renovations. This requires that we determine:

a. Where do these coatings exist?

b. Is the physical condition of the coating such that fiber can be released?

c. Can the material be encapsulated or must it be removed?

Because of the complexity of the distribution system and the fragmented nature of the construction industry, it would be virtually impossible to automatically locate all school buildings which contain these coatings. The only logical approach will be for the school districts to request an analysis, if they feel that there is cause for concern.

It should also be pointed out that not all school buildings constructed in the critical time period will have asbestos-containing coatings, and furthermore, not all fibrous appearing coatings contain asbestos fiber, and not all asbestos-containing coatings are of the extremely friable type which could result in the release of airborne concentrations of asbestos.

Asbestos spray-on ceiling materials or coatings can be segregated into three general classes, based on their friability or durability. First, and possibly most durable, will be paints and other decorative coatings which have a large proportion of binder to solids. Only sanding or other abrasive action will cause fiber release. Second, and also very durable, will be the "cementitious coatings" which contain portland cement or gypsum plaster as the bonding agent. These products will require very intense mechanical action to release fiber. Finally, the least durable type consists of asbestos fiber, in many cases combined with rock wool, loosely bonded with a small amount of clay. This latter product can release fiber with relatively low energy input.

The final question, namely, should the material be removed or encapsulated, will be addressed later in this statement.

As I previously indicated, On December 21, the Environmental Defense Fund filed a petition with the Environmental Protection Agency requesting EPA to take certain steps to eliminate the emission of asbestos fiber from spray-on materials which have been applied in public school buildings for insulation, fireproofing, decorative or other purposes. This document quite adequately summarizes the position of those who feel that the presence of these coatings represents a health hazard to the occupants of the building. There are, in our opinion, several flaws in the arguments presented in the petition as well as the omission of pertinent information which has a bearing on the analysis of the risk associated with the presence of the spray-on coatings, as well as an absence of an accurate analysis of the extent of the problem.

Much of the information in the petition is based upon the report by Dr. William J. Nicholson entitled, "Control of Sprayed Asbestos Surfaces in School Buildings: A Feasibility Study", reported to the National Institute of Environmental Health Sciences in June of 1978. This report contains much data on the alleged presence of airborne concentrations of asbestos in certain school buildings in New Jersey. In addition, this report contains a great deal of pertinent information which was not included in the petition. However, before commenting specifically on the data set forth in that report by Nicholson, it is first necessary to discuss some of the problems inherent in attempting to quantify airborne concentrations of asbestos.

QUANTIFICATION OF EXPOSURE

One of the most important factors in evaluating the risk associated with the asbestos-containing spray-on coatings is the magnitude and nature of the exposure. The quantification of exposure to asbestos fiber in the occupational environment is normally carried out by the phase contrast microscopic method prescribed by the National Institute for Occupational Safety and Health (NIOSH). This method has been widely used since 1965. Although this is the approved and currently accepted method, it is generally recognized that the precision decreases significantly as the concentration of asbestos fibers in the air falls to lower and lower values. This method was never intended for, nor can it be considered suitable for, the quantification of fiber concentrations in non-industrial and non-occupational situations.

The Environmental Protection Agency has been quite concerned with this problem for several years. They have sponsored a considerable amount of research within their own organization and in other institutions in an attempt to develop appropriate methods to quantify the amount of asbestos fiber in both air and water. At the present time, there is no method available which can be considered reliable and accurate at low concentrations. The basic problem relates to the precision and accuracy of the available techniques. Most competent workers agree that the presently used methods leave much to be desired.

The fibers normally found in the ambient air and in non-occupational environments are generally extremely small; so small that they cannot be detected or measured using the finest optical microscope. It is, therefore, necessary to turn to the much more expensive and sophisticated electron microscope in order to detect and measure the fibers which might be present. This requires the introduction of many more sample processing steps which in turn cause a greatly increased probability of error in the analysis. In most atmospheric samples, the asbestos fiber may represent only a small fraction of one percent of the total suspended matter in the air. Because the concentrations of asbestos fiber are so extremely small, one must also be extremely cautious to prevent contamination of the samples by minute amounts of asbestos fiber which may be present in the laboratory.

The analytical method used by the Mt. Sinai laboratory (by whom Dr. Nicholson is employed) has been generally referred to as the "rubout method". In this method, the sample is prepared for examination using very intense mechanical action or grinding. This grinding breaks down all the particles present in the system; asbestos as well as other atmospheric particulates. Advocates of this method feel that the grinding "opens up" the sample so that minute asbestos fibers will not be obscured behind larger nonfibrous particulates.

One of the major problems with this method is that no information is available on the original size distribution of the fibers as they existed in the air. It is only possible to report the total mass of fiber present. Most medical authorities agree that the fiber size distribution is essential to determine if a health risk exists. The reporting of the total mass of asbestos fiber present in terms of the units of nanograms per cubic meter bears little or no relationship to any known quantification of human exposure in the occupational setting. It also bears no relationship to the exposure received by animals in the biological experiments which have been carried out with asbestos fiber. In other words, such units cannot be related to any available data on the health effects of occupational and para-occupational exposures to asbestos. Many scientists actively involved in this difficult analytical problem agree that an electron microscope method which allows characterization of the fibers as they existed in the air would be infinitely more meaningful.

It is possible to go through a mathematical exercise to attempt to relate asbestos fiber measurements in terms of fibers per cc by the optical method to nanograms per cubic meter by the electron microscopic method. If we assume that the smallest fiber that would be counted by the optical method is five micrometers long and 1.67 micrometers in diameter, we can calculate that the concentration of 2 fibers per cc would be equivalent to a mass of 58,000 nanograms per cubic meter. This figure must be considered to be a minimal correlation, since the sample would obviously include fibers smaller than those counted in addition to a respectable percentage which would be significantly larger than this minimal size. It is very possible, therefore, that an optical count of 2 fibers per cc would be equivalent to 100,000 nanograms or more per cubic meter. On the same basis, if we refer to the discussion of the animal experiments by Wagner et al on page 18 of the EDF petition, it is very important to realize that the exposures in this case of 12 milligrams per cubic meter are equal to 12,000,000 nanograms per cubic meter, a figure which is incomprehensively higher than any measured concentrations in the real world - including occupational exposures.

While keeping in mind this discussion of the problems inherent in attempting to quantify airborne concentrations of asbestos, I would now like to comment on some of the data set forth in the Nicholson report and not in the EDF petition, with respect to reported asbestos fiber concentrations in certain New Jersey school buildings.

MAGNITUDE OF THE PROBLEM

Tables 13, 15 and 16 of the Nicholson report (attached hereto as Appendix I) give the results of asbestos fiber concentrations in certain school buildings under a variety of conditions. All of these results are expressed in nanograms per cubic meter as measured by the electron microscope rubout method. These data represent a total of 60 samples taken within the schools under a variety of conditions. In only 12 of the samples was the concentration of asbestos fiber in excess of 200 nanograms per cubic meter. In only one instance (Table 13 of the Nicholson report) was a concentration of 1,950 nanograms per cubic meter reported. This is an extreme sample which was measured while sweeping in a relatively confined hallway. It should be pointed out at this point that work practices recommended by OSHA suggest that asbestos fiber should be cleaned by wet mopping or by vacuum cleaning to prevent the reentrainment of an excessive amount of fiber-containing dust.

The Nicholson report also includes several tables showing fiber concentrations in terms of fibers per milliliter as measured by the NIOSH optical technique. It is very interesting to note that only under conditions of extreme high levels of physical activity do the asbestos fiber counts exceed the current OSHA standard of 2 fibers per cc. Again, the concentration of 17.05 fibers per cc as reported in the petition, is an exceptional value under unusual conditions.

It is essential to note that all of the data reported on fiber levels in school buildings are based on very short time samples, and therefore only can be considered as representing peak exposures, rather than 8-hour time-weighted averages, the basis upon which the OSHA 2 fiber standard is measured.

A most interesting aspect of the Nicholson report is that it does not include any statement regarding the risk, if any, to the occupants of the school building from exposure to the fiber concentrations present. Again, I refer your attention to the appended statement by Paul Kotin, M.D., which addresses itself to the crucial issue of the assessment of risk.

The Nicholson report also includes some data with respect to the number of schools with asbestos-containing ceilings which may be releasing asbestos fiber. Table 10 of the Nicholson report (attached hereto as Appendix 2), indicates that in the State of New Jersey, 142 school districts were surveyed which had a total of 261 school buildings. Of these, only 25 districts reported "visible flaking" of ceiling coatings in their buildings. In many cases, only a small percentage of the total ceiling area in the buildings in the school district was found to be in poor condition. A calculation from the numbers available in this table reveals

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that only 5 percent of the asbestos-containing ceilings in the State of New Jersey are in a state of poor repair. Unfortunately, no data exist to determine whether the situation in New Jersey is representative of conditions throughout the country.

CURRENT ACTIVITIES

Before providing you with our recommendations, it is worthwhile to briefly review some of the activities of EPA which will likely impact on decisions which will be made by school districts with respect to what renovative action may be considered and how it should be undertaken.

The Environmental Protection Agency has had an active program for at least the past year. This program includes three major aspects: (1) A contract with the GCA Corporation to develop a series of detailed work practices which can be used to safely remove damaged asbestos coatings. This document was completed and published in March 1978 and is available to the general public as well as contractors interested in engaging in this type of activity. (2) A contract with Battelle-Columbus (Columbus, Ohio) to determine the effectiveness of various commercially available materials for sealing and encapsulating existing asbestos coatings. This work is nearing completion and will include a list of available products which can be used for the stated purpose as well as recommended methods of application. The final product will include a motion picture demonstrating how best to apply the coatings. Robert Sawyer, M.D. of Yale University, has been an active consultant on both of the above projects. (3) In addition to the above contracts, the EPA awarded another contract to GCA Corporation to prepare a guidance document for distribution to school districts which will provide technical and analytical assistance in dealing with sprayed asbestos materials in schools. School districts will be able to use this document to determine whether or not they have asbestos coatings in their buildings and how to determine what renovation action, if any, should be considered.

When this entire package is completed, presumably within the next few months, the EPA will be in a position to advise the school districts on a recommended course of action depending upon the conditions which may exist in each individual case.

The above activities can in no way be construed as a lack of action as implied in the EDF petition. What it does show is an ordered and responsible reaction to a problem. In addition, a sincere attempt is being made by EPA to be in a position to provide technical and analytical guidance prior to nationwide publicity concerning the situation. We support EPA in its efforts to formulate a voluntary action program and urge the Subcommittee to also lend its support in this worthwhile endeavor.

RECOMMENDATIONS

It is our recommendation that the EPA be encouraged to continue on its present course of action. Any disruption at the present time could lead to a situation where decisions are made without proper and accurate information and large amounts of money expended needlessly by school districts. Within the next few months the EPA should be in a position to guide a school district thorugh the following sequence on a logical basis:

1. A school building can be examined, following published guidelines, for the presence of spray-on asbestos-containing coatings.

2. If suspect coatings are found, they should be analyzed by a competent laboratory for the presence of asbestos. It will be necessary for the guidelines to indicate acceptable sampling methods.

3. If a coating does contain a significant amount of asbestos fiber, the next step will be an accurate evaluation of its physical condition (friability and state of repair) as well as its accessibility to accidental or malicious damage. The subsequent action, if any, will be dictated by the results of the foregoing evaluations.

    a. If the coating is of the cementitious type, and not friable, no renovation action is necessary.

    b. If the coating is friable, but in good repair and not readily accessible, encapsulation with an appropriate coating material can be considered.

    c. If the coating is friable, in poor repair and/or readily accessible to damage, removal can be considered.

In addition to the above, there are several other factors which must be taken into consideration. For example, if the coating has been applied as a thermal insulation, or as a fire-resistant barrier, it will be necessary to replace it after removal. This could lead to extremely high expenditures and consideration should therefore be given to adequate encapsulation. Also, fire-resistant barriers on steel structural members or corrugated metal can be extremely difficult and expensive to remove. Generally such applications are "hidden" above false ceilings and are not readily accessible to damage. Therefore, these materials should not be considered for renovation action of any kind.

The above considerations should, if exercised in a reasonable and logical manner, alleviate any concern which might develop as a result of the presence of asbestos-containing spray-on coating in school buildings.

APPENDIX 1

Tables 13, 15 and 16 from Nicholson Report Showing Fiber Concentrations Measured in Schools in the U.S. and Also in Paris, France.

Table 13

Chrysotile asbestos air concentrations in New Jersey schools electron microscopic analysis

School & District	Sample Location	Condition of Asbestos Material	Sampling Time (min)	Asbestos Concentration (ng/m^3)
District 9, School 1 (loose, fibrous spray)	Hallway	Damaged	69	320
	Girls Locker Room	Flaking	103	80
	Cafeteria	Intact	176	53
District 20, School 1 (cementitious)	Girls Locker Room	Slightly damaged	263	43
	Hallway	Damaged	173	280
	Outside Parking Area		110	3
	Physical Ed. Office	Intact	180	26
District 115, School 2 (fibrous spray)	Sweeping of Hallway	Slightly water damaged	10	1,950
	Dry mopping of hallway	Slightly water damaged	10	230

With the exception of the first sample, no asbestos was visible on floors during sampling procedures.

Table 15

Chrysotile asbestos air concentrations in New York and Massachusetts schools

Sampling Location	Sampling Time (min)	Asbestos Concentration (ng/m^3)
Massachusetts school		
Corridor with sprayed-on, painted asbestos high and unreachable.	360	47
Library with sprayed-on painted asbestos high and unreachable.	376	38
Store room--recent duct work installed in asbestos sprayed area.	362	240
Corridor with hung ceiling above which is sprayed-on asbestos; panels are occasionally disturbed.	390	170
Stage with asbestos sprayed-on steel beams; recent construction activity.	334	260
New York schools		
Hallway sprayed with friable asbestos containing plaster.	190	54, 105, 135 (3 samples)
Swimming pool sprayed with fibrous asbestos.	180	9
Music room sprayed with fibrous asbestos--visible damage.	180	80

From: Environmental Sciences' Laboratory data.

Table 16

Distribution of asbestos* concentrations in the ambient air of school building rooms in Paris, France

Asbestos Concentrations (ng/m³) Less Than	Number of Samples	Percentage of Samples
1	5	10.4
2	7	25.0
5	13	52.1
10	6	64.6
20	4	73.0
50	6	85.4
100		85.4
200	1	91.7
500	3	93.7
1000	3	100.0

* Eight samples had measureable amounts of amphibole asbestos are the values listed include both chrysotile and amphibole concentration. Of the seven values above 100 ng/m³, only one has an amphibole contribution.

From: Sebastien, P., Gaudichet, A., Dufour, G., Bonnaud, G., Bignon, J. and Goni, J. Enquete metrologique sur la pollution atmospherique interieure des batiments isoles par projection d'amiante (1977).

APPENDIX 2

Table 10 from Nicholson Report Showing Condition of Asbestos-Containing Spray Coating in New Jersey Schools

Table 10

Sprayed asbestos in New Jersey schools

District	No. of schools	Square feet Visible flaking reported	Square feet No flaking reported
1	1		18,188
2	1		15,155
3	1		2,500
4	3	8,878	16,804
5	1		1,988
6	1		14,088
7	1	630	
8	1		2,342
9	1	3,577	54,585
10	3		38,770
11	1		2,400
12	3		30,085
13	1		1,500
14	1		3,428
15	4		21,200
16	1		7,200
17	1		2,606
18	2		9,444
19	2		10,300
20	1		5,131
21	1		11,000
22	1		40,000
23	3		134,000
24	1		9,900
25	1		33,330
26	1		10,000
27	4		51,065
28	1		3,100
29	1		4,800
30	1		4,250
31	3		145,400
32	3		2,100
33	1		8,000
34	1		2,728
35	1		61,337
36	2		22,300
37	1		9,000
38	5		405,460
39	1		8,570
40	2	1,953	9,726
41	4		2,586
42	1		11,235
43	1		802
44	1		1,344
45	1		56,229
46	12		50,000
47	1		1,832
48	1		1,180
49	3	2,560	1,280
50	1		600
51	1		2,354
52	1		5,235
53	1		2,750
54	1		42,000
55	1		7,580
56	1		51,085
57	2		9,241
58	1		1,200
59	1		1,296
60	1		500
61	1		45,279
62	1		50,000
63	1		49,695
64	2	1,360	
65	1		11,008
66	2	50	700
67	1		46,000
68	1		30,000
69	4		26,100
70	1		5,875
71	6		14,082
72	5	35,000	22,500
73	1		6,0[illegible]
74	1		2,000
75	1	7,180	
76	4		13,747
77	1	1,701	11,681
78	4	8,470	3,933
79	1	1,574	
80	6		17,530
81	9		162,421
82	1		6,000
83	2		3,000
84	2		4,977
85	1	300	16,500
86	3		5,370
87	1		33,330
88	1		450
89	1		5,000
90	2		1,972
91	1		1,175
92	1		[illegible]
93	2		1,370
94	1		55,000
95	1	1,979	15,290
96	2	1,952	1[illegible],653
97	2		21,751
98	1	3,373	
99	1		520
100	2		10,000

(continued)

Table 10 (continued)

District	No. of schools	Square feet Visible flaking reported	 No flaking reported
101	4		4,500
102	1		5,462
103	1		1,090
104	1		1,640
105	3		16,100
106	1		48,320
107	1		7,913
108	1		12,537
109	1		7,811
110	1		42,336
111	1		2,092
112	1		3,500
113	2	2,000	19,582
114	2	7,700	1,200
115	4	19,251	20,055
116	1		1,800
117	1		1,070
118	8		8,800
119	4	112	41,727
120	1		1,600
121	1		10,300
122	2	1,333	133,700
123	2		28,700
124	3		20,700
125	2		27,438
126	2		5,739
127	1	1,966	30,000
128	1		1,386
129	1		583
130	3		9,189
131	1		160
132	1		1,385
133	1	23,237	
134	1		450
135	1	6,000	2,000
136	1		1,500
137	3		17,704
138	1		1,000
139	1		150
140	1	5,659	790
141	1		5,320
142	1		15,350

[The statement of Dr. Kotin follows:]

WRITTEN STATEMENT OF PAUL KOTIN, M.D.

TO

HOUSE OF REPRESENTATIVES

COMMITTEE ON EDUCATION AND LABOR

SUBCOMMITTEE ON ELEMENTARY, SECONDARY, AND VOCATIONAL EDUCATION

JANUARY 8, 1979

RE: OVERSIGHT HEARING ON THE POSSIBLE HAZARDS
ASSOCIATED WITH THE PRESENCE OF ASBESTOS
IN SCHOOLS

My name is Paul Kotin, M.D. I am Senior Vice President, Health, Safety and Environment, of Johns-Manville Corporation, headquartered in Denver, Colorado. I regret not being able to appear in person at this important hearing. However, previous commitments prevent me from being in Washington on January 9.

Many concerns have been expressed regarding the necessity of remedial actions to eliminate the possible emission of asbestos fibers from asbestos-containing spray materials that have been used in school buildings. Therefore, I believe it is essential for the Subcommittee, as well as other interested parties, to carefully consider the relevant medical/scientific literature that permits an evaluation of the extent to which the existence of these asbestos-containing materials may pose a risk of injury to health or the environment. Obviously, a proper decision on the need for and the extent and nature of possible corrective action cannot be made without first carefully evaluating the extent to which a health hazard does, in fact, exist.

Because of my considerable knowledge and experience with regard to health hazards associated with asbestos, I am convinced that although, based on current knowledge, asbestos-containing spray materials in school buildings represent an inappropriate use of asbestos, no evidence exists to indicate that the presence of these materials poses a health hazard to anyone.

Under ordinary circumstances, the presence of asbestos in ceiling materials is a situation no different from that which exists by virtue of asbestos comprising a significant part of the earth's crust. Scientific literature establishes that background concentrations of asbestos are unrelated to any increase in disease. The application of energy can release fiber from asbestos ceilings; however, this is sporadic in time and place and evidence of an excess of asbestos-related disease is exclusively limited to exposures occurring under occupational and paraoccupational circumstances.

The occurrence of asbestos-related disease resulting from excessive exposure in occupational and paraoccupational environments is well documented. Equally, the crucial role of cigarette smoking in the pathogenesis of lung cancer in workers exposed to asbestos is similarly universally recognized. The issue at hand is whether exposure to asbestos as it occurs in public buildings, schools, and other structures carries with it an increased risk of asbestos-related health problems.

Integral to addressing this issue, it is imperative to recognize that asbestos fibers in common with all environmental chemical agents interact with the human body in conformity with certain recognized principles of toxicology, biochemistry, physiology, and pathology. These principles include:

1. The existence of a dose-response which is the dominant governing factor in assessing any hazardous agent's potential effect.
2. For all agents, including chemical and physical carcinogens, a no-effect level has been demonstrated. Under controlled laboratory conditions, the

reality of "subcarcinogenic" or "noncarcinogenic" doses of chemical carcinogens are consistently recognized and routinely used in both fundamental and applied studies on the biology of cancer.

3. In common with all agents whose carcinogenic potency is primarily related to physical properties, there exist critical dimensions of fibers that determine in fact whether a carcinogenic effect can be produced. This is not a unique property of asbestos fiber. In the absence of reliable fiber size and size distribution studies in school environments, one can only fall back on the generic indictment of asbestos as observed in the occupational situation, but one cannot specify any hazard in the school situation being investigated.

4. Latency (interval between onset of exposure and manifestation of cancer) is a characteristic of cancers induced by all carcinogens. Understandably much has been made of the special risk intrinsic to the exposure of children, with particular analogy being drawn between the school situation under study and the exposure of children under paraoccupational situations. The data available clearly support the fact that the latent period in children exposed paraoccupationally falls within the same time intervals as that observed for adults under the occupational situation; therefore special biological susceptibility has not been demonstrated. Attempts to equate exposure of children in schools with the paraoccupational exposure are unsupportable inasmuch as exposure levels and dose response considerations are the determinants of any potential effect.

5. One is constantly faced with the repeated statement that paraoccupational or familial exposures were low-dose exposures. There are no data to support this, and this may be a good time to address the issue of low dose. Dose by definition is the product of multiplying the concentration of the agent by the time of exposure. Either component alone incompletely defines dose. In fact, a brief period of time in the presence of high concentrations can yield a product no different than a long interval of exposure to a lesser concentration, keeping constantly in mind the existence of a no-effect level for carcinogens. The school exposure situation does not replicate the situation seen in the studies on paraoccupational and familial asbestos diseases.

6. The single most important observation in relation to exposure to low levels of asbestos relates to studies made on general populations residing in areas where asbestos is a large component of the earth's crust. These populations include the newborn to the senescent, with exposure to asbestos in the air due to continuing soil erosion and in water as part of the normal geologic effects. Studies of these populations carried out worldwide, but most particularly by the National Cancer Institute, consistently fail to show any impact on morbidity or mortality due to this life-long exposure to measurable concentrations of asbestos in these two compartments (air/water). Consistent with this documentation of a no-effect level are the results of a study of a roofing worker population and a study of residents in Paterson, New Jersey, conducted by scientists from the Mt. Sinai School of Medicine. In both of these studies there was no evidence of an excess of asbestos-related disease in spite of the fact that these populations were exposed to asbestos fiber concentrations that can be presumed to be higher than normal ambient levels.

Careful analysis and application of these principles to the evaluation of risk to those exposed to asbestos ceilings in schools forces one to conclude that indeed such _ risk has not been demonstrated. Asbestos and many other potentially hazardous agents share a mutual presence in the environment with no demonstrated risk, and such is the case in this instance.

Dr. Leineweber. As you are all probably aware, the Environmental Defense Fund filed a petition with the Environmental Protection Agency on December 21 in which EDF requested that EPA "require the manufacturers and processors of such fiber to take appropriate corrective action to eliminate the emission of asbestos fibers from surfaces which have been sprayed with such materials."

It should be noted that EPA cited Sections 6(a)(3), 6(a)(5), and 6(a)(7) of the Toxic Substances Control Act as the authority for such EPA action. However, the Act only authorizes the EPA Administrator to take such action if he "finds that there is a reasonable basis to conclude that the...use...of a chemical substance or mixture...presents or will present an unreasonable risk of injury to health or the environment."

We believe EPA cannot and should not take the action requested by EPA as there is no evidence to indicate that the existence of the products in question "presents or will present an unreasonable risk of injury to health or the environment."

As Dr. Kotin aptly states on page 2 of his written statement, "because of my considerable knowledge and experience with regard to health hazards associated with asbestos, I am convinced that although based on current knowledge asbestos-containing spray materials in school buildings represents an inappropriate use of asbestos, no evidence exists to indicate that the presence of these materials poses a health hazard to anyone.

Thereafter, Dr. Kotin elaborates on his reasons for reaching this conclusion. I urge you to read this statement, and I will be glad to attempt to answer any questions which you may have in regard to Dr. Kotin's statement.

After consideration of the matter at hand, it is very interesting that the EPA commenced the preparation of a voluntary action program to provide the nation's school districts with technical and analytical assistance in dealing with sprayed asbestos materials in schools.

We initially supported this effort by EPA and still support it. To the best of our knowledge, EPA has devoted a considerable effort in this regard.

It was our considered opinion at the time that regardless of whether EPA took action or not, a certain number of school districts were so concerned, or were under such pressure, that renovation action would be undertaken in any event.

Therefore, if renovation action was going to be undertaken by school districts regardless of the actual existence of a health hazard, we felt then, and still feel now, that it is worthwhile to provide the nation's school districts with the necessary technical and analytical assistance so that they can make an informed decision.

Therefore, we support EPA's efforts to institute a voluntary action program and will continue to assist them in this regard.

As another example of the reasons for our concern, if a school district decides to replace the ceiling material, it is important that the school district and the contractor it retains be fully informed as to the proper techniques to perform this work, so as to minimize asbestos contamination during renovation.

In conclusion, we felt that the voluntary action program by EPA and cooperation with Johns-Manville would provide accurate technical information and therefore avoid unnecessary actions and expenditures and further avoid the possible creation of needless exposures to asbestos which otherwise might occur.

At this point I would like to go into some of the background information, some of which has already been covered, so I will skim over that.

Asbestos-containing coatings were widely used for fireproofing, acoustical and decorative applications from approximately 1950 through the early 1970s.

Since the turn of the century, many building codes have required that the steel beams and columns in high-rise buildings be protected with a suitable fire resistant coating.

Because of their very low mass, asbestos-containing spray-on coatings were used extensively to satisfy this requirement. These products permitted the construction of taller buildings with an added margin of safety for the occupants.

Their unique properties also led to their extensive use as acoustical and decorative ceiling coatings.

At the end of the 1960s and in the early 1970s the Federal Government, as well as the asbestos industry, became aware of the fact that the use of these asbestos-containing spray-on coatings represented a possible hazard to the workmen responsible for their application and a release of asbestos fibers into the ambient air.

This awareness led to an active search for substitute materials, and the ultimate banning of their use by the EPA in 1973.

I feel that the main questions which must be addressed at the present time are what is the risk presented by these spray-on coatings to the present occupants of the buildings and what can be done to alleviate any hazard, real or perceived?

In answer to the first portion of this question, we submit the appended statement of Paul Kotin, M.D., Senior Vice President, Health, Safety and Environment for the Johns-Manville Corporation.

His conclusion is that, "...no evidence exists to indicate that the presence of these materials poses a health hazard to anyone."

At this point I would like to digress a little bit to a few points that are not in my written testimony and addressing the question of risk in terms of is there a dose response.

This is something that has been discussed quite a bit in detail this morning. I think there is an increasing body of evidence which indicates that there is a dose response.

First of all, if I may, go again to Dr. Kotin's statement. Number 4, on page 3 of his statement, latency, the interval between onset of exposure and manifestation of cancer is a characteristic of cancers induced by all carcinogens.

Understandably, much has been made of the special risk intrinsic to the exposure of children, particularly the analogy being drawn between the school situation under study and the exposure of children under para-occupational situations.

The data clearly support the fact that the latent period in children exposed para-occupationally falls within the same time intervals as those observed for adults under occupational situations.

Therefore, a special biologic susceptibility has not been demonstrated. Attempts to equate exposure of children in schools with the para-occupational exposure are unsupportable inasmuch as exposure levels and dose response considerations are determinants of any potential effect.

Basically, he is saying there does not appear to be any special susceptibility in young children. I believe Dr. Sawyer addressed himself to that point, too.

Now, the other evidence that seems to be building up in terms of the lack of the presence of a dose response, even Dr. Rall earlier mentioned someplace in between, where we now have in the environment and what we have in the high level occupational exposures lies the level at which disease will manifest itself.

Unfortunately, it is very difficult to determine where that level exists.

A second point to be made is this past summer at the meeting of the asbestos workshop in New York City, the New York Academy of Sciences, Dr. Hammond and others in association with the Mount Sinai group, presented a paper in which they studied the health and disease among the people who lived in the neighborhood of the Paterson, New Jersey asbestos plant.

This, incidentally, is the plant where Dr. Selikoff's first cohort was found with the high incidence of asbestos-related diseases.

In this group, there was no difference in the health experience of the people living in the vicinity of the plant but not working in the plant as opposed to a group some distance from the plant.

I think one of the interesting points in this is the early attempts to clean up this extremely dirty factory were accomplished by opening the windows, turning on fans, and blowing all the dust out into the neighborhood.

So, these people were not subject to normal ambient environmental concentration of asbestos fiber, but something that was over and above what we might even find in the school situation.

Another recent paper in relation to the question of dose response is a paper by Dr. Whitwell and others in England, in which he measured the burden of asbestos fibers in the lungs of a large group of people. This is an autopsy.

He found very definitely that the existing fibers found in the lung tissue at the time of death regardless of the cause of death was somewhat of an indicator of the occurrence of asbestos-related diseases.

2 1

Only in those patients which had a relatively high burden of asbestos fiber was there any real incidence of disease. Again, some sound evidence for dose response.

One question that has been raised quite frequently is the family or conjugal exposure of the asbestos worker from the days when the conditions were extremely dirty.

Estimates have been made—in fact, measurements were made, I believe, by the Mount Sinai group—in a household several years after the family had left and the factory had been closed down that the concentration in this house after that period of time was as high as 5,000 nanograms per cubic meter.

That is an extremely high figure. So, at the time the family was living there, that must have been extremely high, again indicating that the so-called familial exposures were extremly high and maybe approaching those of the occupational situation.

There is another point which has not been addressed, or only in a minor way, which is the concept of which sizes of fibers, et cetera, are responsible for the disease.

There is a great body of evidence particularly from animal experiments which very strongly indicate that not all size fibers are biologically active.

It is those fibers which we call long and thin. I believe the most definitive work on this score is that by Mr. Merrill Stanton of the National Cancer Institute, who has very elegantly described the size effect in his animals in that fibers which are longer than eight to ten micrometers in length and less than 1-1/2 micrometers in diameter are those which are most biologically active.

So, this means that all the fibers that are in the air are not going to be responsible for disease.

Now, we have no way of relating this to the human experience because unfortunately we don't have controlled experiments with human beings.

One other point I would like to address, the subject has been brought up that the human lung is a sequestering agent for asbestos fiber. The human lung does retain asbestos fiber. It retains a portion of everything that is inhaled.

I think we know that there is so much dust in our environment, so much dirt, if the human lung did not have the capability of somehow cleansing itself, we would probably now have what would resemble concrete lungs, particularly among those of us who have been smokers.

So, the human lung can clear at least some of the debris that it has been challenged with. The mechanisms are pretty well known among the medical people—the so-called mucociliar escalator and the macrophages which clean out the areas that are not available to the mucociliar escalator.

So, everything that the patient has breathed does not stay. I think that is a misconception.

Now, in my testimony I mentioned that much of the information in the Environmental Defense Fund's petition is based on the work done by Dr. Nicholson in his report on the situation in the New Jersey schools.

This information leaves something to be desired in that if one goes back and looks at the data as it exists, there are several tables in which the results of the asbestos fiber concentrations in certain school buildings was measured under a variety of conditions.

All of these results are expressed in nanograms per cubic meter as measured by the electron microscope. Dr. Sawyer addressed the problems of measurement, and I wholeheartedly agree that it is extremely difficult to measure low levels of asbestos fiber in the environment.

In fact, the EPA is very much aware of this and still has ongoing programs to develop reasonable methods which can be used to determine what concentrations do exist in the environment.

So, any method we have now is strictly makeshift in a sense. We are just doing something to get a number. What this number means is open to a lot of question.

In fact, nanograms per cubic meter, what does that mean, how does that relate—if we take some of the other theories of asbestos-related diseases, particularly the size concept, if we just give a mass, we know nothing about the size, so therefore that number is very meaningless in trying to ascertain what the risk is.

Now, if we go back to the Nicholson data in the New Jersey schools, they took a total of 60 samples under a variety of conditions. These data do not only cover the New Jersey schools, there are some in Massachusetts, there are some in Europe, and some from Connecticut, I believe.

Out of 60 samples, only 12 of these samples were at a concentration of asbestos fiber in excess of 200 nanograms per cubic meter. The figure of 1950 nanograms was only one extreme case which was taken under unusual conditions that would not normally exist in a normal occupation situation in the school.

In fact, that was done by doing a dry sweeping test. Many years ago OSHA recommended that asbestos not be cleaned up by dry sweeping. It should be cleaned up either by wet mopping or using a vacuum cleaner with an extremely efficient filter so you don't redisperse the fiber into the system.

Now, there are several other tables which include fiber concentrations in fibers per milliliter as measured by the NIOSH technique. As Dr. Sawyer pointed out, this is extremely unreliable when we get down to low levels. Very, very few of these numbers even came close to the current level of two fibers per cc, which is the current OSHA limit.

The newer OSHA limits that have been proposed of one-tenth of a fiber per cc, and the peak of .5, are really based on the fact that this is the lowest concentration you could possibly measure.

It is not based on any medical evidence or anything else—what can we possibly measure as a lower limit. So, that is the only logic that has gone into that particular number.

I would like to point out that the Nicholson report did not include any assessment of the risk. All they did was include data about the occupational situation, data about the neighborhood and the familial and conjugal exposure, but no conclusions as to what this meant.

Now, today Dr. Nicholson did give us some conclusions based on that.

Now, in a survey of the New Jersey schools, Nicholson reported out of 142 school districts surveyed there were a total of 261 buildings. Basically, only 25 of these school districts reported visible flaking of the ceilings in their buildings. In many cases only a small percentage of the area of the ceilings were found to be in poor condition.

Going through the numbers that were presented, the numbers indicated that only 5 percent of the asbestos containing ceilings that were found in the State of New Jersey were in a bad state of repair.

There is one unfortunate fact. We don't know at this time how to extrapolate from the data in New Jersey to what is happening in schools around the rest of the country.

Now, I have mentioned that the EPA has had several activities going on to do something about this problem.

Their programs include what I say are three major aspects. One is the contract they have with the GCA Corporation to develop a series of detailed work practices which can be safely used to remove damaged asbestos coatings.

This document was completed and published in March of 1978 and is available for the general public as well as contractors interested in engaging in this kind of activity.

The second is a contract which is now underway at Battelle-Columbus, in Columbus, Ohio to determine the effectiveness of various commercially available materials for sealing and encapsulating existing asbestos coatings.

This work is nearing completion and will include a list of available products which can be used for the stated purpose, as well as recommended methods for application.

The final product will also include a motion picture demonstrating how best to apply these coatings. It is interesting that Dr. Sawyer, who has just finished testifying, has been an active consultant on both of these projects.

The third, the EPA has awarded another contract to GCA to prepare a guidance document for distribution to the school districts which will provide technical and analytical assistance in dealing with the asbestos materials in schools.

The school districts should be able with the availability of these documents to determine whether or not they have as coatings in their buildings and to determine whether or not renovation action is necessary.

Our contention is that the above activities in no way can be construed as a lack of action as implied in the Environmental Defense Fund petition. What it does show is an order and responsible action to a problem.

In addition, a sincere attempt is being made by the EPA to be in a position to provide technical and analytical guidance prior to a nationwide alert concerning this situation.

We wholeheartedly support the EPA in these efforts to formulate a voluntary action program and urge that the subcommittee also lend its support to this worthwhile endeavor.

Our recommendations are that the EPA be encouraged to continue its present course of action. Any disruption of this at the present time could lead to a situation as was discussed earlier where school boards and school districts without any proper and accurate information will possibly be expending large amounts of money to correct situations which may not require correction.

The following sequence of events is what should take place. A school can be examined following whatever the published guidelines turn out to be, to determine if the school does indeed contain asbestos containing spray coatings.

I wholeheartedly concur with Dr. Sawyer in that this is not a simple analytical problem. It takes a good deal of perfected technique in order for a microscopist to identify whether or not a material actually is asbestos fiber.

It cannot be done by the type of person who is doing the occupational counting, and cannot be done with the type of equipment that they use.

The second stage would be if a suspect coating is found, it should be analyzed by a competent laboratory. If the coating does contain a significant amount of asbestos fiber, the next step will be an accurate evaluation of its physical condition, friability, and state of repair, as well as its accessibility to accidental and malicious damage.

The subsequent action, if any, will be dictated by the results of the foregoing evaluations.

If a coating is of the cementitious type, which is generally hard and can almost be considered encapsulated as it stands, most likely no further action is necessary. If the coating is friable but in good repair, and not readily accessible, then encapsulation with an appropriate material can be considered.

If the coating is friable, in poor repair, and/or readily accessible to damage, removal can be considered.

In addition to the above, there are several factors which must also be taken into consideration. For example, in many cases the coating has been applied as a thermal insulation or a fire resistant barrier.

If this is removed for the continued safety of the occupants of the building in case of fire, it is going to be necessary to replace the fireproofing coatings with a substitute material, which would lead to extremely high expenditures.

In the case of thermal insulation it would be a necessity to replace also because there are certain situations where school buildings are built out of quonset huts, and if the insulation were removed, these would turn into ovens, and the children could not survive in that environment.

Generally, many of the fire resistant type compounds are hidden behind false ceilings and not very accessible. Therefore, these materials probably can be considered not necessary for renovation action of any kind.

The above considerations should, if exercised in a reasonable and logical manner, alleviate any concern which might develop as a result of the presence of asbestos containing spray coatings in schools.

Thank you.

Mr. MILLER. Mr. Levine?

STATEMENT OF HERBERT LEVINE, PRESIDENT, SPRAYCRAFT CORP.

Mr. LEVINE. My name is Herbert T. Levine. I am with Spraycraft Corporation in New York.

I want to thank you for the opportunity of making some input into this problem which exists and hopefully we will be of some benefit to the entire situation.

Asbestos has been used for many years because of its ideal properties and the strength which it lent to the materials which incorporated it.

It was used in sprayable materials, despite the fact that it was probably by far the most costly ingredient in the formulation, but it was used because of the properties of tensile strength, knitting of the long fibers, ability to absorb and shed water innumerable times without affecting the installation, and the fact that it attributed to the light weight of the material, which was a combination of asbestos fibers, mineral wool and mineral binders.

Therefore, the use of the material became—well, the first uses, after World War II, occurred in the early 1950s. The major purpose for which the material was used in buildings and in schools was for thermal insulation or acoustical control.

At that time the investigation of the fire retardant properties had not progressed very far. So that the use is sporadic, spasmodic, and not of great volume.

It was in the middle or the latter fifties when the construction industry determined that steel frame buildings permitted structures to be erected much faster and cheaper than installing reinforced concrete buildings, that the proliferation of testing with Underwriters Laboratories took place, and materials developed for use as a fireproofing medium, and a larger volume developed.

During all this period there have been no indications of any hazard present in the use of asbestos, although economics dictated that a product such as we are speaking about could not afford to have much more than 20 percent by weight of the asbestos materials.

Most of the instances in which these school installations were made were exposed areas and were all sealed with a liquid sealer, which prevented the possible dusting of the material.

I have seen some now that must be 20 years old and where they have not been vandalized by anybody. They are as intact as they were in the original installation. I doubt very much that anyone could find a contribution of asbestos fibers in the air if any samplings were done in those asbestos areas.

When the occupation hazard of the use of asbestos began to be publicized, we, as a small industry, determined to form an association of our own to investigate the potential hazards, the methods that might be used to enable us to conform with the regulations at the time in force, and we found that this was fairly successful.

We did run tests of various sorts in accordance with the state of the art at that time to determine whether our products in spraying afforded a greater contribution of fiber into the air than was permitted by law.

We succeeded in various ways in bringing down the counts of fibers during the spraying method by improvement in the application methods, improvement in the equipment which was used to install it, and improvement in the manufacturing processes, which meant that each of us separately and independently came upon a method of treatment of the fibers during manufacture to render it less dusty in application.

When the standards were changed from five million particles of air per cubic foot to five fibers per cc, which was a drastic dimunition of the permissible amount of fiber, we were able to have our products comply with those requirements, and ran adequate tests to prove that with proper application methods in the field, all of this could be accomplished.

When Dr. Selikoff first came to the fore with the possible hazards of asbestos, we were all involved in consultation. We joined in the activities of his committees. I personally was put on the first committee that was formed at the New York Academy of Sciences for the investigation of asbestos and what to do about it.

The presence of asbestos in schools to the extent that it is accessible to view and susceptible to damage has been, I think, substantially exaggerated. The high volume of usage of the materials with asbestos occurred when they were used for fireproofing purposes, because of the steel columns and so on that have to be fireproofed.

The areas in which it was used for decorative effect or for thermal insulation were limited in scope to music rooms, where they had to cut down on the reverberation of sound in the room, so that the courses could be adequately conducted; in boiler rooms, where they wanted to prevent the migration of heat from the heating system into the principal's office, which might happen to be over the boiler room and keep the asphalt tile from melting.

These installations were all made with these surface sealers which did not affect either the acoustical properties of the material or the thermal insulation values.

The concern with the fireproofing materials and the possibility of dusting and flaking arose with the General Services Administration here in Washington, D.C.

The members of our association, with people from the GSA, devised formulations for testing the circumstances and the test procedure to indicate whether our material complies with the GSA regulations for dust erosion are still in effect, and they were devised by efforts both of GSA and of our manufacturers.

It resulted in an article being published in the American Heating and Ventilating Magazine expounding the reason for running the tests in the fashion in which they were run.

The coatings which might be used and the fact that at 800 feet per minute of air velocity going parallel to the face of the material there was no erosion of the material since it was used in return air plenum where the air was then reintroduced and recirculated for air conditioning. What I am trying to say is that as hazards or possibility of existence of hazards arose we did not turn our backs on it and say we will let it go away. We did everything we possibly could to assist.

As a matter of fact when Dr. Selikoff started his first group at Mount Sinai, Johns-Manville along with the asbestos workers were the largest contributor to this effort, this function. In our modest way even our small association contributed to it so we could learn what has to be done to bring our material to the position where under the state of the art it would be readily acceptable.

Dr. Sawyer has mentioned the fact that air sampling is probably not a viable way of measuring what is going on. But up until this point those are the only circumstances which we had to indicate whether we are in violation of any regulation or not. I still think that air sampling is a viable method of determining whether there is any hazard in the area in question.

The materials which were installed behind hung ceilings, et cetera, might be brought into excellent condition, if any damage exists, merely by using a liquid overspray or sealant. Those areas exposed to view and which have been badly vandalized may require being taken down. But each instance would have to be reviewed by itself and the proper course of action to remedy that situation be determined.

I believe that mention was made previously about the involvement of the Board of Education of the City of New York and the circumstances which exist there. I just wanted to read a quotation which appeared in the *New York Times* on November 29, 1978 to the extent that an official of the New York City Board of Education, Mr. Anthony Smith, said, and I quote, "Scientists, engineers and architects who have surveyed the school buildings had recommended structural containment." That is the end of the quote.

Removing the asbestos could cause problems by allowing its release into the air, he said. I am sure that all of our esteemed medical men who are involved here would indicate that haphazard removal might lead to a greater hazard than exists now because of the migration of the fibers into the air existing that was being rectified. I do think that the situation requires very careful consideration, very minute examination and a viable and economical way of bringing the circumstances around to where they become nonhazardous.

The circumstances might call for removal, they might call for repair and resurfacing with a sealer, or they might call for encapsulation structurally behind the hung ceilings which currently have been used in school corridors, et cetera, where the material, asbestos-containing material was used as a fire-retardant medium and not exposed to view.

It is the intention of those of us still in the spray fiber industry to assist in every way possible in bringing about these circumstances. We have succeeded in some areas in writing specifications for sealing asbestos-containing surfaces and two such specifications now exist, one with the General Services Administration of the State of New York and one with the county of Los Angeles, where remedial work has been done in accordance with that specification. I do believe with all of the heads getting together which can make input into this situation, we can come up with a much simpler way of attacking the problem than running scared and ripping out all of the material.

Thank you.

[The complete statement of Mr. Levine follows:]

TESTIMONY BY HERBERT L. LEVINE, PRESIDENT OF SPRAYCRAFT CORPORATION

There are many properties to the mineral asbestos which have made it invaluable over the years as an essential ingredient in fire protective coatings, safety clothing, theatre curtains,brake linings, admixes with other materials to add appropriate extreme tensile strength and toughness, i.e. asbestos cement pipes, sheets, shingles, etc. and ultimately as a basic ingredient for fire protective coatings for structural steel frame buildings. Asbestos is unique in the fact that its very fine single strands of fibre have extreme strength and can be used to reinforce other products, which accounts for its presence in cement pipe, flooring of various types, roofing of various types, and many other products in use every day in which the asbestos is locked into the final product and prevented from possible emission into the air.

The first use as a sprayable material with asbestos occurred in profusion during World War II, when it was widely used for insulation of ships, submarines, etc. After World War II, asbestos was in very short supply with great quantities being used for corrugated asbestos-cement sheets for reconstruction in Far-East, etc. To continue the use of the spraying techniques for thermal insulation and acoustical treatment, the use of a mixture of mineral fibres with asbestos and mineral binders for spraying purposes was introduced. These products,which were made by many manufacturers, contained approximately 20 to 30 percent asbestos,mostly of the chrysotile type such as comes from Canada, and some with amosite, which comes from South Africa, and affords longer fibre for the same amount of money, although slightly lesser tensile strength. The earliest use of these blended fibres occurred in early 1950's with most installations being made for acoustical correction and decorative finish and a goodly portion for building insulation, such as to the underside of ceilings above boiler rooms and mechanical rooms, to prevent the loss of heat into the occupied areas above.

For these two purposes, we find earlier school installations with all of the material exposed and generally sealed with a sealer applied in the liquid state which did not adversely effect either the acoustical or thermal properties of the material. Widespread use was also made of this type of material to ceilings of indoor swimming pools for noise control and to prevent moisture condensation. These sealed areas also prevented any dusting or flaking of material and where not mechanically or forcibly damaged, these last indefinitely without shedding any fibres. It has even been scientifically proven that installing additional coats of liquid sealer to refurbish or refresh the appearance of the installation does not reduce either the acoustical or thermal insulation properties of the installed fibrous materials.

In the late 1950's and 1960's, the use of these types of materials became very widespread as a fireproofing medium to lightweight, steel frame buildings, with metal decks supporting concrete floors. This method was much quicker and, therefore, cheaper than reinforced concrete construction, and resulted in widespread use of these fibre type products with asbestos and cementitious types which also contained a moderate percentage of asbestos. Many tests were run at Underwriters' Laboratories for the various products to obtain UL approval for use with the varying types of cellular steel floors which were developing.

It was found to be rather advantageous to use the plenum above the architectural ceiling line to gather return air in the air-conditioning system. The Federal General Services Administration was concerned about the ability of the material to resist erosion, under the mild velocity of air flow generated in this system, and in consultation with fireproofing material producers, developed a specification for testing to a strict standard to make certain that no erosion occurred. These criteria still prevail in the General Services Administration specs, V.A. specs, and are rather widely used as an industry standard also. Most school buildings, however, were four or five story concrete structures, with the use of fibre restricted to the areas previously mentioned, namely, music rooms, lunch rooms, libraries and, in a few instances, in indoor swimming pools where they existed.
In the late 1960's suspicion began to develop that inhalation of asbestos could be harmful. Therefore, the manufacturers of sprayed mineral fibre materials founded the Sprayed Mineral

Fibre Manufacturers Association in 1966, to test its products in accordance with the then existing state-of-the-art, to act in concert to make certain that our products complied with the particle requirements set down by the authorities. Accordingly, the Association commenced a serious testing program to determine that we complied with the regulations existing at that time. Between December 1966 and August 1969, the Association conducted some six series of tests and the individual companies each continued their own testing program. Our own company has run some five tests through February 1972, even testing the non-asbestos materials for compliance with the Threshold Limit Value (referred to as TLV) of dust particles as specified by the American Conference of Governmental Industrial Hygienists.

The early tests were run to indicate fibre counts under various conditions of water supply from the gun-heads which wet the materials and binders as sprayed, to various blends of ingredients and dust arresting additives. This latter development in the manufacturing processes were the turning point in cutting down the generation of dust in the spraying application.

I referred previously to testing in accordance with the "state-of-the-art", since the criteria for acceptability changed dramatically through the years. In our first tests in December 1966, the acceptable standards were 5 million particles as a TLV, for asbestos dust per cubic foot of air. In April 1967, again the standards were the same and the testing agency states that "the TLV for asbestos fibre dust is 5 million particles per cubic foot of air. It is considered that exposure to asbestos dust in concentrations of less than 5 million figure will not lead to the formation of Asbestosis. Asbestosis is more likely to occur after long continued inhalation of asbestos dusts in high concentration such as may exist in a mining, milling or cutting operation of asbestos". Working with the results of the tests, in June of 1967, by refined installation techniques, use of proper equipment and modification of manufacturing methods, the test results indicated that the results were all below the 5 million particles per cubic foot of air, which is the Threshold Limit Value for the type of dust involved.

In July 1969, tests were conducted in several buildings where asbestos containing material had previously been installed, several years before. The summary states that:" It has been determined by air sampling and microscopic evaluation that there is no exposure to asbestos fibres of respirable size in the work environment in the new Federal Building in Newark,New Jersey, on the main rotunda of the Trans World Airlines Terminal Building at J.F. Kennedy Airport, New York City. There is no exposure of dust in general that would lead to lung involvement on the part of employees or the general public in the three buildings. Greatest exposure to dust of any nature occurs outdoors, in the area occupied frequently by the general public and not within the buildings studied."

As the state-of-the-art progressed, our testing programs were conducted to the existing standards. In 1972, for instance, the criterion TLV was "not more than 5 fibres 5 microns or greater in length per mililiter of air", and our material tested well within these parameters. As a matter of fact, at that time we anticipated the announced change to 2 fibres per mililiter and still were within that acceptable range.

To comprehend the magnitude of this change from particles per cubic foot to fibres per mililiter,the value of 5 fibres per mililiter of air would convert to 141,581 fibres per cubic foot per air or a reduction by 97% in allowable fibres. Relating that to 2 fibres per mililiter of air allows a total of 56,632 per cubic foot or a reduction of 98.87%.

When the asbestos hazard possibility was receiving publicity in the media, we all attempted to cooperate. We served on the pioneering investigative committees established by Dr. Selikoff in the New York Academy of Sciences in New York and worked closely with his group at Mount Sinai in New York. Members of our industry attempted to comply with all restrictions,caveats, etc., and when required, all had statements on the bags in which materials were shipped, calling attention to the asbestos content and its possible hazards. Throughout this period of time, we all tried to develop viable non-asbestos containing products and with ultimate complete success and full UL approval. We also investigated methods of preventing fall-out from previously installed asbestos containing materials and have come up with feasible liquid sealants which work extremely well, are comparatively inexpensive and provide the bonding characteristics required. Such specifications have been written by the General Services Administration of the State of New York, the City of Los Angeles,and also have been used on occassion by the V.A. Hospital group.

We do appreciate the possible danger of exposure, especially when malicious mischief damages the surfaces and permits the possible migration of asbestos into the air.

A cold realistic approach should be taken to these circumstances and scare reactions must be tempered to remove the hazards and restore the integrity of the treatments as reasonably as possible. Fortunately, air sampling and particle counting can now be done quickly and it is most important that each location be tested to see what the quantity of asbestos released into the air is. Once this has been established, then the treatment can be recommendand carried out.

In extreme instances, where the damage is great, it may be necessary to remove the material completely, an expensive and possibly hazardous procedure, because of the possibility of some material being dislodged further into the air.

Where suspended acoustical tile or gypsum board ceilings exist below the asbestos treated surfaces,then the surfaces should be sealed and the hung ceiling restored to make that area tight and not permit any possible seeping of the material into the air. Where areas are high enough so they cannot be damaged maliciously from the floor then the loose material should be removed carefully adn the exposed asbestos containing materials, again, be sealed with the appropriate liquid sealant.

We can set a date in early 1973 when asbestos spraying was banned by the Federal EPA and be assured that all installations from that time on contained no asbestos.

We must also steer away from a scare reaction such as developed in South New Jersey in January of 1977, when a local physician there discovered a new disease to which he referred, completely ignorantly, as "Asbestos Disease". Very little publicity was afforded a short time later when it was admitted tha the swollen glands which the student developed resulted from Mononucleosis and not from asbestos exposure.

I want to revert back to some of the ways in which the Sprayed Mineral Manufacturers Association cooperated in attempting to minimize any possible hazard, in accordance with the state-of-the-art at that particular time. We funded a study, in accordance with the standards arrived at by the General Services Administration, in cooperation with the Association, and this resulted in an article being published in the December 1968 publication Air-Conditioning, Heating and Ventilating. This analyzed the velocities which might exist at any particular point in the return air plenum system and justified the requirements of the GSA for such areas. I point this out, by way of indicating the extreme pains to which this group went and the sums of money they had expended to come up with the appropriate answers for the hazards as they appeared to develop. Any hearings or meetings held in any part of the country and Canada were attended by or monitored in behalf of the Association members so that we could make input where it was helpful and be kept abreast of developments in the field of asbestos exposure.

A good deal of my time was made available to Dr. Selikoff in many conferences to discuss, mutually,the aspect of asbestos fobre and to take advantage of my experience in the field of asbestos and sprayable material. I am sure that a good deal of the information transmitted to Dr. Selikoff on asbestos came from these many hours spent together for this purpose. Representatives from our industry made themselves available frequently to assist in investigating the asbestos situation and to try and minimize the exposure of workers and the general public to asbestos.

When it became obvious that a ban on spraying materials with asbestos would ultimately be the law of the land, we turned to developing non-asbestos products, albeit that there are no products or ingredients, natural or synthesized, which can begin to to substitute all of the properties which are inherent in asbestos fibres. We have turned out good products without asbestos, that is completely without asbestos, and other ingredients that might be considered harmful, such as free silica. Since this has been achieved, it is rather puzzling that the Federal EPA regulation still permits the use of products containing not more than 1% asbestos. There is, unfortunately, no medical evidence that sprayable materials with 1% or less of asbestos are not harmful. Therefore, the law should ban products containing any asbestos, since only in this way can we be certain that currently no asbestos is being sprayed

Now to return to the areas in schools which had been installed previously and how to treat them. I reiterate the previously mentioned statements that we should not stampede into a single method of treatment or ripping out material, but rather consult with knowledgeable people as to the best remedy for each situation. Have air sampling taken, determine if any asbestos is present in the ambient air, and use the mose economical way of resolving the situation. As an official of the New York City Board of Education, Mr. Anthony Smith said on November 28, 1978, as reported in the New York Times on November 29, 1978, "scientists, engineers and architects who have surveyed the school buildings had recommended structural containment." Removing the asbestos could cause problems by allowing its release into the air,he said. Dr. Selikoff at Mount Sinai and Dr. Robert Sawyer at Yale University, I am sure, concur with the methods I have suggested. It does not have to cost fifty million dollars,a number recently quoted, to make safe the schools in New York City. Using various methods,as the individual circumstances dictate, this task can be achieved at a cost much less than that quoted. The job has to be done, but it has to be done judiciously, to achieve the desired results for the least possible cost. Again, the effectiveness of the results is most important. I could go on and on and cite many instances where the wrong approach has been used or is contemplated to be used, but that is not necessary, since feasible methods exist to remedy the situations, provided that the proper diagnosis is made first and the appropriate treatment is then followed.

Mr. WEISS. Thank you. Mr. Joseph Mohen.
[The prepared statement of Mr. Mohen follows:]

PREPARED STATEMENT OF JOSEPH MOHEN, PRESIDENT, AMERICAN ENERGY PRODUCTS

Asbestos is a word used to describe an extremely coarse fibrous mineral. The word asbestos is from the Greek and means "not extinguished," recognizing the most prominent physical characteristic of the fibre, it's virtually absolute resistance to degredation from fire.

These long coarse fibers could be not only combined with other minerals to result in fire resistant compounds but also spun into fabrics creating flame proof drapes, and other types of protective materials.

The coarse "spider-legged" look of the fiber provided the capability to combine well and thoroughly. As our technology improved asbestos was introduced into a variety of new products. Automobile brake shoes are today kept cool under extended use because of their asbestos content. Floor and roof tiles used asbestos as not only a fire resistant additive but also as a binding agent. Asbestos was combined in gypsum wall board and other basic building materials to enhance their strength and durability. By the late 1960's there was almost no aspect of industry that did not utilize the benefits of asbestos in some way.

As the sixties progressed, Dr. Irving Selikoff, currently with the Environmental Science Laboratory of Mount Sinai School of Medicine in New York City, was prominent in demonstrating the physical effects to industrial workers who ingested raw asbestos fibers. Those same coarse "spider-legged" fibers which formed an excellent bond when combined with other materials, would permanently bond to the lining of a workers lungs resulting in a carcinogenic environment.

The National Cancer Institute claims the 67,000 people die annually from asbestos related cancers and the Department of Health, Education, and Welfare estimates that between 8 million and 11 million people have been exposed to asbestos in the United States since World War II.

CURRENT SITUATION

The demands of unions, and individuals like Dr. Selikoff were enough to cause a reaction by governing code agencies for industrial workers who are now protected by Federal, state, and local regulations.

Current standards of protection provide that industrial workers cannot be exposed to asbestos, mica or free silica without elaborate safeguards

The mining industry however is subject to different standards. The acceptable degree of exposure involved for miners is different than that permitted for industrial workers.

The fireproofing industry, aware of the physical properties of asbestos, agressively utilized it with other materials.

As the market for direct-to-steel spray applied fireproofing expanded, greater quantities of asbestos were utilized with other materials until in some cases asbestos represented as much as 30% of the formulae blended. At one point almost all spray-applied materials including acoustical and thermal insulations as well as fireproofing contained asbestos.

After recognizing the dangers involved, the spray-applied materials industry rapidly phased-out the use of asbestos. By 1971 it had been totally eliminated as an additive, although it may still be present in the raw mineral ore of some materials which is permissible according to current Federal government regulation.

Today most commercial industrial and institutional buildings are treated thermally and acoustically. All are made fire-resistant according to the local code authority. The materials used to achieve the standards involved are certified by each manufacturer regarding the use of asbestos and in most cases, this certification has been verified independently.

There are also millions of square feet of building area which were insulated either for thermal, acoustical or fire resistant reasons, prior to the elimination of asbestos as an additive.

EACH SITUATION UNIQUE

Although the danger of exposure to raw asbestos fibre has been recently described, there has not as yet been any unified approach to the treatment required, if any, for those buildings in which asbestos containing materials had been utilized. Many school and hospital administrators, moreover, upon learning that buildings under their jurisdiction had utilized asbestos-containing materials, react as if they were in charge of factories which were processing raw asbestos fibres and insist upon its removal. This reaction is understandable, expensive, and, probably, unnecessary.

Asbestos, as stated previously, makes an excellent bond and once combined seldom tends to release. The materials installed by a good craftsman should offer no danger particularly if enclosed and sealed as would be the case in most instances of thermal and fireproofing installations.

Acoustical work is generally exposed to view. Anything so exposed might be subject to damage, particularly in schools.

Each instance, each installation must be considered separately. Acoustical ceilings over ten feet high are probably safe from damage whereas mechanical-room-ceilings although restricted in use are generally lower and therefore accidental damage might occur. Asbestos-containing materials which are enclosed and not subject to mechanical damage offer little, if any, danger.

TEST REQUIRED

If a school or hospital administrator were in doubt as to asbestos exposure, testing laboratories are available to take air samples and test these for asbestos content. The facilities of the Environmental Science Laboratory of Mount Sinai School of Medicine can offer very specific advice and assistance in this area.

If the results of the air sampling test is positive, immediate changes are necessary. If the results are negative, little is required except, perhaps, to better protect the asbestos containing materials from accidental damage. Certainly, dismantling and tearing down is not required until all other alternates are considered, particularly if no danger or hazards are involved.

If asbestos containing materials are exposed to view and the institutional administrator is concerned, the entire surface can be oversprayed with a sealer which has been certified as a fixative for particulate including asbestos. This overspray should be tinted to insure visual inspection of the sealed area.

The overspray/sealer should also be certified as as to provide a capability to withstand erosion according to the requirements of the General Services Administration PBS 4-09200 (10/74).

The overspray/sealer can be applied with paint spraying equipment and would be sufficient to seal exposed to view asbestos containing materials in high ceiling areas such as auditoriums. This treatment which can be done quickly, i.e., when schools are not in session, would probably cost under 20¢ per foot installed including material and labor.

When enclosed areas are being renovated, i.e., wall partitions being moved or expanded, they should be treated as if exposed to view and oversprayed.

Sometimes more elaborate protection is required. Schools in southern New Jersey had instances of acoustical ceilings being deliberately torn down by students as part of the temper of the time. In these instances a technique, known in the trade as an "overcoat" ought be employed.

A thermoplastic which will carbonize intact under heat when sprayed over the entire area will totally encapsulate or "overcoat" the substratum without appreciably reducing any product benefits, i.e., thermal insulation or fire rating, except for some acoustical properties. This technique which can also be applied quickly, when school is not in session, may cost between $3 to $5 dollars per square foot installed including material and labor. It not only seals the asbestos containing materials but also provides almost absolute protection against accidental damage.

This methodology is now being employed to seal-off and protect the computer facilities of a major manufacturer against not only asbestos fibres but even nuisance dust.

RECOMMENDATIONS

I would recommend a uniform standard for exposure to free silica, mica or asbestos which would be applicable to all suitations. If this standard existed, not only would factory and industrial workers be protected but miners and all others would have meaningful criteria to use. In addition, institutional administrators would also have a standard to use and thereby eliminate much of the confusion which now exists.

Joint tape compounds and certain other materials still used in the building industry contain free silica. We have a federal regulation regarding the specific language used on cigarette packs. I'd suggest a clear, pronounced, similar warning of uniform size and color for any bag or package of building material, particularly those used in schools and hospitals, if they contain free-silica, mica, or are reduced from asbestos containing raw ore.

Finally, I'd suggest that there is no cause for panic if an administrator discovers that the institutions under his responsibility utilized asbestos-containing materials. Enclosed areas shouldn't represent any hazard at all. Properly installed areas are equally safe. Questions as to level of exposure can be resolved by consulting a competent testing laboratory and the Environmental Science Laboratory of Mount Sinai School of Medicine in New York City is an example.

When greater protection or abrasion resistance is desired overspray/sealer which fix asbestos particulate and reduce erosion within the level of General Services Administration standard PBS 4-09200 (10/74), can be employed at reasonable cost.

Each situation ought be considered individually. The problems created by our technology can be solved reasonably and effectively for those to come if we work together.

STATEMENT OF JOSEPH MOHEN, PRESIDENT, AMERICAN ENERGY PRODUCTS

Mr. **Mohen**. Thank you. My name is Joseph Mohen. I am the president of American Energy Products. We manufacture sprayed mineral fiber materials that are used for fireproofing, thermal insulation and acoustical control, all without asbestos, I might add.

There are many materials in the building industry, even today, that include asbestos. I dare say that probably in your own house the roof tile contains asbestos and perhaps in your own kitchen vinyl floor tile is made with asbestos.

Gypsum wallboard no longer includes asbestos but the joint tape compound used to seal it and to add partitions to old school buildings does contain free silica within the OSHA regulations and limitations. So there are many materials still being used in institutions such as schools and hospitals in the United States that do contain these materials—silica, mica, and possibly materials reduced from asbestos-containing ore.

In our business we get many calls from institutions and administrators, people in hospitals and schools, asking for assistance and advice on what to do when they discover a building that is perhaps 10 years old or older was built with asbestos-containing materials, particularly spray-applied and exposed to view. We recommend, if it is not exposed to view, totally enclosed, and represents no hazard, that it not be disturbed. We have no way of measuring hazard.

We reference anybody to the Mount Sinai school merely because we have found in our travels that there are perhaps only three laboratories in the United States that can adequately measure or at least render an opinion on a degree of hazard involved. So we simply tell people to consult Mount Sinai if they are concerned about an asbestos problem.

Secondly, if it is completely closed we recommend it not be disturbed. If it is exposed to view—for example, an acoustical ceiling—we suggest the materials be sealed with a particular fixative, something that would hold in place any asbestos or free silica or mica. That is to say, if it is not subject to mechanical damage.

If it is subject to mechanical damage we suggest it be oversprayed and encapsulated to the degree that it can be kept from being disturbed or accidentally removed. If it is exposed and subject to possible removal, then we suggest that it be removed.

Now Mr. Levine referred to specifications that now exist in the County of Los Angeles for the removal of asbestos. That includes tophauling, protection of the workers, environmental conditions, so forth. These specifications are available. We have distributed them to agencies in the Government, to the Veterans' Administration for their use, but we suggest first off that there be several steps taken if an administrator of any institution—and I personally would like to recommend that you gentlemen and ladies go beyond merely looking at schools, because after all an institution includes people in hospitals, it includes industrial workers, in the type of institution you describe.

There are separate standards for everybody now. The Government ought to just look at one standard: What is dangerous for people? If it is dangerous for industrial workers, is it dangerous also for miners? Is it dangerous for children in school? Is it dangerous for people who travel in motels where acoustical ceilings were applied with asbestos? There should be a standard that would prevent a lot of the confusion and panic. I realize from the testimony earlier this morning that that might be difficult to achieve, but there should be a standard that could be universal. After all, if it is dangerous, it is dangerous.

I address my testimony to the costs involved, what we see. Again, if it is material that is exposed to view, it has been our experience that it can be sealed with a sealant, tinted or clear, a fixative that will hold asbestos particulate in place for 20 cents or less a foot. That could be used as a standard. I do not suggest using that if the exposed material is subject to mechanical damage. If it is subject to accidental mechanical damage, it can be encapsulated for anywhere from $3 to $5 a foot. I have no real ready remedy for vandalism or youthful explosion in the school that would reach up and tear things down. In that case I suggest a substitution be made. As a father of 10 children I would like to protect them, too. I really have no alternate technology to offer there. I do not think anybody does.

I had, as I say, a suggestion that we have a standard for exposure, a uniform standard for exposure to free silica, mica and asbestos, and if materials come from free silica or reduced from asbestos-containing as certain cements, calcinated plasters and so forth, they ought to be so identified.

Lastly, I simply say when an institutional administrator discovers that a building under his jurisdiction contains asbestos that there is really no cause for panic. There are people who have some experience in this area and it is not necessary to rip the building down or just tear the whole thing out. If it is not a source of danger, if competent laboratories like Dr. Sawyer's at Yale, like Mount Sinai, can confirm that no hazard exists, then I suggest we stop at that point, at least in the current state of the art.

If there is perhaps a cause for some remedial action, seal the material, if that is sufficient so that the material would not be disturbed or vandalized somehow, and perhaps that is the place we ought to stop considering the economics involved. I think after talking to Dr. Rall at Mount Sinai the only thing to add is that each situation does have to be considered individually. It is a serious problem but really not a cause for panic, but a cause for analysis and judgment.

Thank you.

Mr. **Miller**. Mr. Weiss.

Mr. **Weiss**. Dr. Leineweber, in listening to your testimony I am not sure that I understand the thrust of your comment. Are you saying that there is no evidence that ingestion of asbestos fiber causes any health hazard?

Dr. **Leineweber**. No, I did not say that. What I meant to say or meant to be understood was that the levels at which the children are exposed to under the situation in the school buildings does not present any evidence of any risk of any health hazard. Going back in time to the high level occupational exposures that we experienced 20, 30 years ago, yes, there is a problem, a serious problem.

Mr. **Weiss**. Let me refer you to page 3 of your testimony, and at the bottom of the page you say that you believe that EPA cannot and should not take the action requested as there is no evidence to indicate that the existence of the products in question presents or will present an unreasonable risk of injury to health or to the environment. Now is that limited specifically to school buildings, is that what you are saying?

Dr. **Leineweber**. It is limited in my mind, and in our mind that this is limited to the exposure one might experience in a building that contains these products, yes.

Mr. **Weiss**. In a building?

Dr. **Leineweber**. In a building, in a public building, private building, whatever it may be.

Mr. **Weiss**. So that you are saying, again correct me if I am wrong, that there is no evidence at all to indicate that the ingestion of any of these friable materials, would cause any kind of health hazard.

Dr. **Leineweber**. There is no body of evidence that exists that clearly indicates that, right.

Mr. **Weiss**. You are now using the word "clearly" to modify it. Are you saying that you believe that it may cause cancer, for example, but that it has not been demonstrated beyond a reasonable doubt or beyond proof certain or proof positive or what?

Dr. **Leineweber**. The way I personally feel, and I believe our position is that under—with the evidence that exists today there is no problem with this level of exposure.

Mr. **Weiss**. Let me take it back a step. You do agree that as far as the workers in industrial plants where asbestos-containing materials were produced or manufactured, that these people because of the conditions and circumstances under which they worked, that in fact, the materials that they ingested were cancer-causing, and were hazardous to their health?

Dr. **Leineweber**. I agree to that with the qualification that particularly 20 or 30 years ago when the situation was under less control than it is today, yes, the inhalation of asbestos fiber did lead to lung cancers and asbestosis.

Mr. **Weiss**. So that the area of disagreement, if I may—again correct me if I am wrong—is as to how much is ingested, is that right?

Dr. **Leineweber**. Yes. It is a matter of the dose response. It has been discussed at great length this morning, how much is necessary to elicit a response.

Mr. **Weiss**. Okay, so that when you take one position as the spokesperson in this instance for Johns-Manville, and Dr. Sawyer or Dr. Nicholson take a different position representing their respective institutions, that there is in fact a clear-cut difference in the conclusions that are drawn; is that right?

Dr. **Leineweber**. Yes, there is.

Mr. **Weiss**. Thank you very much.

Dr. **Leineweber**. This really boils down to an interpretation of the data which are available.

Mr. **Weiss**. I have no further questions.

Mr. **Miller**. Thank you. Mr. Kildee.

Mr. **Kildee**. Thank you, Mr. Chairman.

Dr. Leineweber, everything else being equal, if you had a choice of sending your child to a school with asbestos sprayed ceiling and one which is not, which school would you choose?

Dr. **Leineweber**. Everything else being equal, if I knew the condition that the school containing the asbestos coating was not in a state of disreputable repair such as some of the slides Dr. Sawyer showed, I think I would have no compunction of having a child of mine attend that school.

Mr. **Kildee**. If the ceiling appeared to be stable?

Dr. **Leineweber**. If it appeared stable, I have no compunctions whatsoever.

Mr. **Kildee**. None at all?

Dr. **Leineweber**. None at all.

Mr. **Kildee**. I would.

Mr. **Miller**. In your testimony you state that—and I think you recite a statement by Dr. Kotin in which he found that there was no health hazard to anybody present in a building that had spray materials containing asbestos. And yet he found that it was an inappropriate use of asbestos. I do not understand how those two statements can be in one paragraph.

Dr. **Leineweber**. I understand what you are saying but in essence the industry has decided in the past 8 to 10 years that we will eliminate the use of all applications of asbestos fiber where the products are friable and with a minimum amount of mechanical energy applied will release fibers to the air. We have basically said that this is now an inappropriate way to use asbestos fiber, primarily because of the occupational hazards associated with them and the inability to control them in the occupational scene.

Mr. **Miller**. So that was the reason for the decision why Johns-Manville decided not to manufacture spray asbestos materials?

Dr. Leineweber. We never manufactured them and it was probably a conscious economic decision that it was not an appropriate business for us to be in, to manufacture these particular products.

Mr. Miller. You did not see an economic incentive for you to get into that market which had that kind of rapid growth in terms of volume for your company?

Dr. Leineweber. Not having been actually present and responsible at that particular time I would assume that that may have been the conscious decision.

Mr. Miller. Well then, moving forward a little bit, when the decision was made that this was an inappropriate use for asbestos, however not apparently a dangerous use for asbestos in terms of health, how was this conveyed to your purchasers of your material? Is it conceivable one of your purchasers may incorporate asbestos into their product to spray it? Would you purchase, if I might ask——

Mr. Levine. Yes, we purchased our asbestos in the open market from prime producers. We were merely compounders of material to bring an end result about.

Mr. Miller. Then how are you informed of this decision within industry that it should not be put into friable materials?

Mr. Levine. I do not—from my way of thinking, the reason that Johns-Manville did not get into this is that there was not enough of a market for a corporation of the size of Johns-Manville to become involved in. They still had an interest in it because a lot of the asbestos incorporated therein came from producers like Johns-Manville. So why get involved in something which is minuscule against the entire corporate structure when you could get a good piece of the selling a product which you already had?

Mr. Miller. Did they inform you that they had arrived at a conclusion that this material could be hazardous to insulators?

Mr. Levine. No. The reason they did not get into it is not because of the hazard at all.

Mr. Miller. I understand that. I do not want to put words in your mouth here, but it is my understanding that the corporation made a decision in which as it is inappropriate according to Dr. Kotin, it is inappropriate use of asbestos to include it in a spray material because of health hazards they felt were posed to the occupational working of that material. Was that ever conveyed to you as a person who employs——

Mr. Levine. No. The only circumstance which arose was the necessity for including on the bags in which we shipped our material a caveat as to the fact that it contained asbestos, asbestos might be hazardous, therefore proper precaution should be taken.

Mr. Miller. When did you first start doing that?

Mr. Levine. I cannot recall. I tried to reconstruct it. I do not know. We still have some old bags which we used when we shipped asbestos-containing materials. The statement is on there large and bold, whenever it was required. I do not know whether it was actually a legal requirement or a moral requirement but whenever—at the time it arose we all complied.

Mr. Miller. But according to your testimony, Mr. Levine, on page 2, it was somewhere in the last '60s that this general suspicion of the harmful effects within your industry.

Mr. **Levine**. Yes. Until that time we went on our merry way producing the best product we possibly could with the economics which existed unaware of a possible hazard. The moment that the possible hazard was raised we all participated in finding out what had to be done to comply with the law of the land or the moral requirements. We worked very closely with Dr. Selikoff and his entire group from its inception. I can walk into the laboratory there and refer to all of the eminent doctors by first names since our involvement has been so close with them. I have had Dr. Langer analyze things for me on his electron microscope to find out if there was any asbestos, what the scope and content of the asbestos was, and so forth.

So we have been in this thing up to our ears from the word go until today. We started to look for nonasbestos material before EPA abandoned it completely because we could see the handwriting on the wall. I am not sure the nonasbestos-containing are good as the asbestos-containing materials because we have not had enough time elapse. But we do comply and use products which contain no asbestos, no free silica, and all OSHA requirements are met in the plant. Anything that has to be done has been done and has been properly documented so that we know within the scope of what we have to do. We also know there are ways of remedying the situation which exists today without going wild about it and ripping everything down.

I want to relate one incident that I do not know whether we could enforce it today, because the discipline in schools has dissipated to where it does not exist. Some years ago I was in Albuquerque, New Mexico, a school building entirely coated with asbestos-containing material. I think it had been up for 5 years. There was not one speck of damage in any of the ceilings in the school. It was rather unusual because vandalism exists when kids find out they can shoot paper clips up with a rubber band and have it impinge into the material. I got to the superintendent of the building, asked him how come? He said, "It is very simple. We have a convocation of the entire school body when the semester commences and the principal informs them anybody found vandalizing the ceiling will be expelled." And it worked. We do not have that much control over the kids any more, I am afraid.

Mr. **Miller**. Dr. Leineweber, when this decision was made, did you convey this to the purchasers of your bulk or raw asbestos product?

Dr. **Leineweber**. Yes, we did. In fact I would like to trace a little bit the history of the awareness of the health problem associated with asbestos. If we go back in time in the late '50s and early '60s, the first indications of severe asbestosis and other problems may have been in the asbestos textile industry, one application where the fibers are essentially unbonded, very loosely bound in the fluffy textile materials. The second and major indication was the studies by Dr. Selikoff and his group at Mount Sinai which indicated among the insulation workers there was a high incidence of disease which really was the most definitive work in the field and which brought the situation to the place it is now.

Under these circumstances all of the products that were being used by the workmen in these situations were loosely bonded friable, dusty products. So in light of that background information we made a conscious decision, actually in cooperation with the group at Mount Sinai, we worked together to find new ways of accomplishing the same ends without asbestos fiber, to remove the dusty, friable products from the market. We ourselves made huge investment on pipe insulation to make an asbestos-free product that would satisfy the requirements of the industry in that regard.

Mr. MILLER. What happened to the demand for that product after you notified them of that problem?

Dr. LEINEWEBER. The demand continued for the asbestos-free material. The market for the asbestos-free insulation has probably grown, the asbestos-insulation piping market has probably grown without any discontinuities in time even with the change from asbestos-containing to asbestos-free. The other comment is that in 1964 before——

Mr. MILLER. The demand I was referring to was the sale of the bulk or raw asbestos to be incorporated in the spray materials.

Dr. LEINEWEBER. Much of the marketing of asbestos fiber that we participated in has been done through distributors and in many cases you do not have any control, as the original supplier, what happens when it gets through a distributor.

Mr. MILLER. Did you continue to sell the same volume of raw material that had that designation?

Dr. LEINEWEBER. When the decision was consciously made I would assume by that time the volume that went into that application was starting to go down. I have no data to substantiate that.

Mr. LEVINE. Might I comment?

Mr. MILLER. Yes.

Mr. LEVINE. We are talking in the spray fiber industry about a very small segment of industry. The amount of asbestos which that industry consumed was about 1 percent of the entire consumption of asbestos in the United States. So that if three or four different producers suddenly had no market for their asbestos it would barely show in their sales statistics. It was lost immediately; it did not affect anybody.

Mr. MILLER. That is very helpful, thank you.

Dr. LEINEWEBER. Also at the present time within the past year we have made the conscious decision that we will not sell asbestos fiber through distributors where we no longer have any control over the ultimate application. So we sell directly to the end users so we know what is being done with it, how it is being used and is it of any concern.

Mr. MILLER. In response to and I believe in your testimony but also in response to Congressman Weiss' question, you suggested that it is your position that there is no evidence to show that the low level of exposures of young people in schools is in any way a health hazard; is that a fair statement of what you said?

Dr. LEINEWEBER. Yes, it is.

Mr. MILLER. What would be the evidence?

Dr. LEINEWEBER. The scientific literature.

Mr. **Miller**. What would be the evidence that would show you that that is a health hazard?

Dr. **Leineweber**. I believe there is enough, as I tried to mention in some of my deviations from my written testimony, there is an increasing body of evidence which indicates that there is a very definite dose response with asbestos-related diseases, indicating dose response. So there is an apparent no-response level which is above the level that exists in the schools. If we take the numbers that have been published at 200, 300 nanograms per cubic meter, these very definitely appear to be below the response level.

Mr. **Miller**. Well, I hope you are right, but I am a little concerned, because as I read the literature as a lay person and as I listen to witnesses they are talking about this material as a carcinogenic which does not have a threshold. So to talk about low-level exposures is to beg the issue a little bit, as I understand.

Now I appreciate certainly being corrected if I am wrong and also certainly to be afforded the citations on which you rely because I want to make sure that we are both discussing the same problem. You put forth a statement by Dr. Kotin on page 3, I think it was a statement attached to yours, where he talks about latency, and that latency does not appear to be much different than that of adults, as well as the evidence is.

Dr. **Leineweber**. That latter question is addressed to the problem of: Do children have a higher susceptibility than adults. That evidence indicates that children have the same latency period and, therefore, the conclusion that you can draw is that they have the same susceptibiity as adults.

Mr. **Miller**. When he spoke before the Consumer Product Safety Commission, that is not what he said. He said a rapidly developing cell, a cell which has a shorter turnover time than another cell is perhaps more likely to be subject to the action of a carcinogenic.

That is a little different conclusion about children than what you suggest he is saying here about latency. As I understand latency, we are talking about that time in which you could discover the evidence in which to make the determination as to whether or not this is a dangerous material and whether this is a dangerous level.

We found for shipyard workers it came 30 years later. As a result of waiting for the evidence, we got a chance to count the bodies.

Now, I still don't understand the evidence that you talk about that would be necessary to show, to prove the case that these levels of exposure in fact are not harmful when you have a latency period and you also have the issue of whether or not a child's body would assimilate this material faster than an adult.

Dr. **Leineweber**. It is unfortunate that Dr. Kotin is not here.

Mr. **Miller**. It sure is. We have been trying to get him here for a considerable period of time.

Dr. **Leineweber**. The statement he made before the Consumer Product Safety Commission was sometime ago. As I said before, there is an increasing body of evidence which indicates the fact that there is a no response level that apparently is going to be substantiated.

As I tried to point out earlier in my testimony, all of the evidence is really associated with occupational and the so-called para-occupational, the familial, et cetera.

Mr. **MILLER**. I understand that.

Dr. **LEINEWEBER**. These are the only bits of evidence.

Mr. **MILLER**. It is also from listening to testimony of people not in occupational situations but who were related, some of your former employees who happen to be married, people who happen to be married to your former employees who now have contacted these diseases or happened to have those employees as fathers and mothers and now have contacted the diseases related to asbestos.

So, I am concerned about the threshold or level that is not harmful. We listened to an individual here earlier who apparently is very familiar with the information and the state of the knowledge and he told us that at best we don't know and maybe we ought to use some common sense and where materials are deteriorating, maybe we ought to get them out of schools.

If the evidence has so dramatically changed since Dr. Kotin testified in 1977 before the Consumer Product Safety Commission, we ought to have that made available to us.

Dr. **LEINEWEBER**. In my testimony I said if there is concern over the problem let's do something about it, do something in a logical, stepwise, consistent manner.

Mr. **MILLER**. What are you prepared to do?

Dr. **LEINEWEBER**. I am prepared to support the EPA in their current activities so that when there is a national alert published we can tell the school systems how to proceed and give them good, sound advice on what to do.

Mr. **MILLER**. In the Washington Post there is an article—I think this is 11-17-78—where Mr. Richard Carter, an attorney for your corporation, said that Johns-Manville has offered to help locate asbestos in schools but the company does not plan to pay for cleaning up the asbestos.

Are you currently involved in trying to locate asbestos in schools?

Dr. **LEINEWEBER**. We are currently working with EPA and the Environmental Defense Fund.

Mr. **CARTER**. I would like to clarify that remark quoted by Mr. Richards of the Washington Post. It was not accurate. It was as a result of an interview over the telephone and some words must have gotten lost.

I stated that since last spring we have been working very closely with the EPA and the Environmental Defense Fund. We support EPA's initial determination to undertake a voluntary action program, and we have tried to assist them, for example, in the preparation of a guidance document that will be at some point in the future issued to school districts throughout the country in an effort to tell them how to identify if they do have an asbestos containing sealing material in their school and how to determine which form of renovation activity might be appropriate in their situation or when no renovation activity is arranged at all.

This has been the extent of our involvement and we are continuing to be involved with EPA and the Environmental Defense Fund, and we will continue our cooperative efforts.

Mr. **MILLER**. Thank you for that clarification. I think that is very important in terms of what portion of this burden, the size of which we don't know yet, Johns-Manville is prepared to shoulder or other manufacturers.

I hate to limit it just to Johns-Manville, but other manufacturers or people who have installed it, in helping us to locate it.

Obviously the industry is even removed from you. In terms of distribution and in terms of insulation, it could be a massive help because I am not sure every school record will tell us what is the material that is put into the ceiling or walls.

So, I would hope that in the associated industries the same kind of cooperation is forthcoming.

Mr. LEVINE. There is a succinct way of determining. Every school built has to have a set of plans filed with the local building official. That would indicate what ingredients were used. The time it was installed would dictate to us whether it had asbestos in it or not.

Mr. MILLER. I hate to be cynical, but a lot of times we find out what the government contracts for and what we get are two different things. That is not a bad start, though. I appreciate your help. Let me thank you.

I would appreciate it really if—I don't want to play with the scientific evidence on which we are supposed to make determinations of how to handle this—but I would appreciate very much citations of the evidence in terms of low level exposure and new approaches on thresholds because everything this committee has heard so far both on the occupational side and further has been to the contrary.

I would appreciate that being made available to the committee.

Dr. LEINEWEBER. I would be happy to send it to the committee.

Mr. WEISS. Mr. Leineweber, would you comment on the statement you made at the bottom of page 7 of your testimony which says: "At the end of the 1960s and in the early 1970s the Federal Government as well as the asbestos industry became aware of the fact that the use of these asbestos-containing spray-on coatings represented a possible hazard to the workmen responsible for their application and a release of asbestos fibers into the ambient air. This awareness led to an active search for substitute materials, and the ultimate banning of their use (1973) by the EPA."

Does that mean that your company first became aware of the hazards of asbestos in the 1960s or when did your company first become aware of it as a health hazard?

Dr. LEINEWEBER. That statement is specifically directed to the use of the sprayed asbestos-containing coatings as fireproofing materials in the buildings. This is as a result of Dr. Selikoff's study with the insulation workers and the things I was discussing earlier.

At that time we made the conscious decision to remove the friable, loosely bonded asbestos uses from the market.

Mr. WEISS. When did Johns-Manville first become aware of the fact that there was a health hazard to the people who worked for Johns-Manville?

Mr. CARTER. Let me try to answer that question. We are talking here about our knowledge with regard to the particular product being the spray-on application of sealing materials.

The medical scientific knowledge that we know today regarding the health effects of exposure to asbestos is something that has evolved over many, many decades.

For example, prior to 1964 when Dr. Selikoff did his now famous study of insulation workers, we knew that certain kinds of occupational exposures to asbestos could lead to an increased risk of diseases.

There were studies of miners, millers exposed to asbestos, people in the textile industries particularly in Great Britain who had developed a high incidence of asbestos-related diseases.

We saw it in our own industrial manufacturing diseases.

Mr. **Weiss**. When did Johns-Manville as a company first become aware of this problem for its employees?

Mr. **Carter**. For its employees?

Mr. **Weiss**. Yes.

Mr. **Carter**. Many decades ago. As far as insulation workers, we were not aware of the risk to them until 1964 when Dr. Selikoff did his study. Since then, Dr. Selikoff has done many additional studies.

In the early 1970s he did studies on the exposure levels of workers who were involved in spraying these asbestos-contained coatings on steel beams. That is when we recognized that was an inappropriate use of asbestos because the fibers were not adequately located into the product. We stopped manufacturing that type of product.

Mr. **Weiss**. When you say many decades ago, when do you mean?

Mr. **Carter**. It is difficult to answer because as years went on more and more was learned about asbestos. During the 1930s we supported research at Saranak Lake regarding potential hazards because of exposure to asbestos.

Mr. **Weiss**. The reason I am asking you is because Dr. Leineweber's response indicates that you need more precise data at this point to indicate that schoolchildren may in fact be exposed to a hazard.

I am trying to establish when Johns-Manville first became convinced, persuaded that in fact it was a health hazard to its own employees so that we can engage with some amount of intelligence how much we can rely upon the estimate of Johns-Manville.

Mr. **Carter**. The answer to that question really is not relevant to the question before this subcommittee.

Mr. **Weiss**. You would allow us to make the judgment as to what is or is not relevant, would you not? Dr. Leineweber had indicated that there is insufficient evidence to indicate whether in fact there is a hazard to schoolchildren. To the best of his knowledge, there is not.

There may in fact come a time 20 years from now when there may be sufficient evidence to persuade Dr. Leineweber that the presence of sprayed asbestos presents a health hazard to schoolchildren.

What I want to know is: Since you now said that Johns-Manville admits that to its own employees there has been a health hazard, when did Johns-Manville first come to that conclusion? When was it persuaded that there was a hazard?

Mr. **Carter**. All the evidence that exists, even today, indicates that the hazards from exposure to asbestos fibers are limited to exposures in occupational and para-occupational situations.

There is no evidence today nor has there ever been any evidence showing that there is any risk or hazard from general environmental exposures.

Mr. **Weiss**. Assume that that is true, what I would like to know is when did Johns-Mansville come to that conclusion?

Mr. **Carter**. I am sorry, but I don't know the answer to that question.

Mr. **Weiss**. Well, you said that there was evidence going back decades, that there were studies concluded decades ago. I am asking you whether in fact Johns-Manville came to the conclusion in 1925, 1935, 1945—when did it come to the conclusion that in fact its own employees were working in a hazardous occupation?

Mr. **Carter**. You have to remember the studies, for example, that were available many years ago, back in the thirties and forties, related to very limited occupational settings.

Most of the early studies done had to do with people exposed in the mining and milling of raw asbestos fiber, of people working with asbestos fiber in textile operations. As Dr. Leineweber said, in the textile products were probably some of the most loosely bound product where the fibers were free to be released during manufacture and as well as that, during use.

The studies were preliminary in these areas. There were many other product uses of asbestos fiber not studied until later dates.

Mr. **Weiss**. When those studies come out in the early 1930s Johns-Manville was not in fact persuaded that there was a problem to its own employees?

Mr. **Carter**. We certainly recognized I believe as far back as the 1930s of the risk of development of asbestosis.

Mr. **Weiss**. To some of its employees?

Mr. **Carter**. Yes. You have to recognize that an association between exposure to asbestos and various forms of cancer was not recognized until the late 1960s or early 1970s, as far as its association with bronchogenic lung cancer and mesothelioma. That was not known in the 1940s and 1950s.

Mr. **Weiss**. I have some indication from the story Mr. Richards wrote in the Washington Post that there were studies completed in 1934, 1935, 1936 which in fact Johns-Manville by its own industrial doctrine was successful in having not published.

Mr. **Carter**. I would suggest that you please refer for scientific accuracy to scientific journals and not the Washington Post, with all due respect to the Washington Post.

Mr. **Weiss**. As a matter of fact, the story refers to an industry journal called 'Asbestos,' which apparently had been asked not to run some stories by the then attorney for Johns-Manville.

This goes back to 1935 and the attorney was one Vandiver Brown, who was the Johns-Manville attorney. Is that a sufficiently good source?

Mr. **Carter**. Mr. Weiss, the issue of those documents were well covered in the company's testimony at congressional hearings in Honolulu a month or a month and a half ago. I don't believe this is the appropriate forum to go into that again.

Mr. **Weiss**. I have one final question.

When Johns-Manville became convinced that their employees, were in fact subject to certain health hazards, were those employees notified that in fact they were running a risk of contracting any of these diseases and when they were given physicals, were they in fact told that they were in the process of developing these asbestos-related diseases?

Mr. **Carter**. Not only did I not work with Johns-Manville in those days, I was not even born then. I know from my discussions with other people in the country that starting back in the early 1930s, as we learned more about occupational exposures to asbestos, we kept taking remedial measures to install and improve engineering controls and to continue to reduce occupational exposure to asbestos.

As new government regulations came out lowering the TLVs, we took steps to make sure these lower requirements were met in our manufacturing facilities.

Mr. **Weiss**. Wouldn't you agree with me that an industry such as the one that you are part of is the first one to be asked to pass judgment as to what is or is not health hazard, that you are too close to the hazard as a company, too involved in that industry and cannot possibly be as objective as the doctors who testify?

Mr. **Carter**. I totally disagree with your conclusion.

Mr. **Autry**. Absolutely not.

Mr. **Carter**. We have done a great deal to finance a considerable amount of scientific and health-related research related to asbestos and other materials.

Mr. **Weiss**. I call to your attention that you take the similar position as the tobacco industry takes with relation to tobacco.

Mr. **Carter**. I take strong exception to that. In many papers like the *Washington Post* the tobacco industry denies cigarette smoking is related to lung cancer. We fully recognize that exposure to excessive amounts of asbestos can lead to the development of certain diseases and, therefore, precautions have to be taken and inappropriate uses of the product have to be discontinued, and we have done this.

Mr. **Weiss**. Thank you.

Mr. **Miller**. Let me just say, I don't think all this is as it appears to be. I think Mr. Weiss has touched upon a very salient point, and that is to the credibility of witnesses when they are asking that their recommendations be followed as a matter of public policy by this committee.

It goes to the issue that Mr. Weiss and myself have tried to develop as to the exposure of these schoolchildren to this substance. I think it would be fair to say that when we asked what you did in the occupational area and what you are recommending here, it has some relevance and it is before this committee because there is substantial evidence that either you were ignorant of or ignored substantial scientific evidence, not *Washington Post* articles, but substantial scientific evidence through the late 1920s, 1930s, 1940s, 1950s. Only then apparently, according to testimony by your company, when the definitive Selikoff study was done, was something really determined on how to deal with your workers.

I think with that track record—and I can appreciate your not wanting to comment on it since it is a matter of litigation—but with that track record, I question to what extent we should weigh your recommendations.

I think it is a very important point to put before this committee because this committee has had testimony from your employees that they worked in your plants as late as the late 1960s and were never told of the hazards, even though it looked like a snowstorm inside the factories and they could not see the lights.

I think it goes to the question of recommendations that somehow we have a voluntary effort by a whole lot of other people.

Mr. CARTER. At the same time, I have gotten the impression listening to all the testimony this morning that to a certain extent you have almost tried to put words in the mouths of the various witnesses here today that there is a health hazard presently by the existence of these asbestos spray-on materials in the schools and none have testified to that.

Mr. MILLER. The question were of exposure, whether the scientific committee agrees on thresholds, the question of whether or not the children were different than adults—and the gentlemen from HEW suggested they were—and the question of those exposure levels and whether they can make definitive levels about those.

We may differ on what those exposure levels are but the question of whether you are in an occupational field or whether you are learning reading, writing, and arithmetic has some bearing.

The gentleman here is talking about a universal standard. If you are exposed to it, you are exposed to it. We have seen enough variables on the times of exposure to be concerned. It is not putting words in anybody's mouth. It is trying to establish a basis on whether or not and to what extent this is a problem.

The people in manufacturing, education and otherwise have to be given different weight.

Mr. KILDEE. On that very point, the counsel for Johns-Manville indicated in response to Congressman Weiss that he felt this was not the appropriate forum for a certain question. Let me suggest that this committee does have the power to subpoena records and to administer oaths.

After listening for a while this morning I think we should consider doing just that.

Mr. MILLER. Not being the chairman of this committee, I will not go around issuing subpoenas. That leads to a greater fight than you have ever seen in your life.

Let me say the more I delve into the issue of asbestos-related diseases, the more I think witnesses ought to be sworn.

Thank you very much for your testimony.

Mr. LEVINE. Mr. Miller, may I say something. I hope we will refrain from lumping one industry with another industry. If you want to find out the integrity of the straight fiber industry ask Dr. Irving Selikoff or Dr. Sawyer or Dr. Ralph Nicholson about what we have done to help them.

Mr. MILLER. My comments were directed at the Johns-Manville Corporation here. Thank you very much.

The committee will hear from the gentleman from EPA, and also from the Environmental Defense Fund, if we might, because we are about to lose some membership, I am afraid.

So, if we could include that in a single panel just for the purposes of receiving the testimony, and then we will ask you questions individually.

STATEMENT OF JOHN DeKANY, DEPUTY ASSISTANT ADMINISTRATOR FOR CHEMICAL CONTROL, ENVIRONMENTAL PROTECTION AGENCY, ACCOMPANIED BY CYNTHIA C. KELLY, DIRECTOR, CONTROL ACTION DIVISION

Mr. MILLER. Mr. DeKany, your testimony will be put in the record. If you could summarize because of our time problem, we will appreciate it.

Mr. DEKANY. Good afternoon. My name is John DeKany. I am the Deputy Assistant Administrator for Chemical Control within the Office of Toxic Substances of the Environmental Protection Agency.

My office is responsible for developing the means to control hazardous chemicals under the Toxic Substances Control Act.

One of the chemicals that we have under active investigation is asbestos. I appreciate this opportunity to describe EPA's activities to control asbestos and in particular our program to control asbestos-sprayed materials in schools.

I will begin my discussion with some background on the problem caused by asbestos-sprayed materials and on efforts by the Federal Government to solve those problems.

At this point I would like to provide some background on the various aspects, and the previous witnesses have done that very well.

There are three types of actions schools may take to abate the problem.

Schools may remove the asbestos, encapsulate it or enclose it. Removal is the most effective abatement action, but it generally is the most expensive and is not practical in all situations.

Encapsulation refers to the spraying of the asbestos with a sealant or coating which will bind the asbestos fibers. Enclosure refers to placing barriers between the asbestos and the public; the asbestos fibers remain behind the barrier.

What abatement action, if any, is needed depends on the particular situation in the building, and the most appropriate abatement action is not always readily apparent.

In 1973 EPA prohibited the spraying of friable materials containing more than 1 percent asbestos for use as insulation or fireproofing materials. In June 1978 this prohibition was expanded to cover spraying for any purpose.

The EPA regulations were promulgated under the authority of the Clean Air Act to prevent the unsafe introduction of asbestos fibers into the outdoor ambient air.

However, concern over existing problems with indoor air contamination has continued within EPA, particularly in the last year with identification of the school problem. We have held a number of meetings with asbestos industry representatives and the Environmental Defense Fund in an attempt to assess the situation.

EPA has retained Dr. Robert Sawyer, one of the nation's few experts on the specific problem of asbestos in buildings, as a consultant. Dr. Sawyer has addressed this subcommittee this morning.

Last October EPA conducted a telephone survey of the States in order to inform ourselves of the status of State programs and to establish contacts with the appropriate public health, education and environmental departments which have some degree of responsibility for asbestos control within each State.

In the fall EPA also established contacts and held meetings with school board associations, the Academy of Pediatrics, the AFL-CIO, and others to take advantage of a wide variety of viewpoints on this difficult subject.

These contacts have aided EPA in disseminating information on asbestos in schools and have resulted in a number of articles such as the one recently published in the *American School Board Journal*.

This article presented many of EPA's viewpoints on the problem directly to school administrators.

EPA has also worked with the Department of Health, Education, and Welfare, which has supported continuing research in this area. In 1977 the Public Health Service issued a bulletin to all local public health officials apprising them of the potential hazard of exposure to asbestos in buildings. In August 1978 Secretary Califano wrote to the Governors about this problem, identifying contacts within HEW and EPA for further information and assistance. The Secretary's letter placed emphasis on schools and on voluntary action in those schools where hazards exist.

EPA has developed a four-part asbestos control program relying on voluntary efforts by the States and school districts as the best approach for collecting data on the extent of the problem and getting a control program going as soon as possible.

The four parts of the asbestos control program area: (1) preparation and dissemination of a Guidance Package; (2) training of field personnel; (3) developing a quality assurance and technical assistance program; and (4) developing a reporting program. EPA is proceeding with these parts simultaneously.

The Guidance Package will consist of two manuals and a reporting form. EPA's telephone survey revealed a need by State and local officials for reliable information on how to identify asbestos-sprayed materials and what to do to control them. These manuals will satisfy that need.

The first manual will be a handbook written in non-technical language. It will explain how to look for asbestos in a school, how to determine what is the most appropriate abatement action, and how to make certain that a contractor performs an abatement action properly. A draft of this manual has been distributed on a limited basis for comment, and we are getting back good comments which will help us produce a better manual. The final version should be completed by the end of February.

The second manual is much more technical in nature. It explains in detail how to perform a laboratory analysis for asbestos and what procedures to follow in taking abatement actions. It also explains what Federal regulations must be met when taking corrective actions. This manual was published last March by EPA's Office of Air Quality Planning and Standards and is currently available upon request. It will be useful to analytical laboratories and to contractors performing abatement actions.

The Guidance Package will be mailed in March to the Governors, State asbestos program contacts and every school district in the nation. In addition, EPA will begin a training program to explain how to use the manuals.

The training program will be given to EPA's regional Toxic Substance Coordinators, to HEW regional coordinators, and to State and local officials.

EPA has contracted for the production of a videotape which will illustrate the material in the non-technical manual. Copies of this tape will be made available to State and local officials.

The third part of the asbestos control program is the quality assurance and technical assistance program. EPA will prepare a manual that will specify a procedure for performing bulk analyses for asbestos. State and local officials will be able to use this manual to make certain that the samples that they collect are properly analysed for asbestos.

The final part is the reporting program. A reporting form will be sent to every school district as part of the Guidance Package. School districts will be requested to report to EPA, either directly or by way of a State agency, on the results of their inspection, sampling and what actions, if any, were taken. These data will enable EPA to determine the full extent of the problem and to evaluate the success of the asbestos control program.

This asbestos program has a number of major advantages.

First and most important is that the program can be implemented much faster than a rule can be promulgated. The program will get under way in March when EPA mails a Guidance Package to every school district. Promulgation of a rule would take at least one year because of the need to comply with established regulatory and administrative procedures including the preparation of detailed exposure and economic analyses. A rule could be delayed even longer if challenged legally.

A second advantage of the asbestos control program is that it complements rather than conflicts with existing State programs. Over thirty States have existing programs to control asbestos-sprayed materials, and this number should increase once the Guidance Package is distributed.

EPA is confident that State and local governments will cooperate because they share mutual concern with EPA about protecting the public health. EPA values the cooperation of State and local officials and believes the currently planned program is the best way to obtain it.

A third advantage is the ability to maintain flexibility in order to minimize the cost of taking abatement actions. The problem caused by asbestos-sprayed materials varies greatly from building to building. In some buildings asbestos-sprayed materials are intact; in some they are rapidly deteriorating.

In some buildings asbestos-sprayed material is readily accessible; in others it is not.

The costs of different types of abatement actions also vary significantly. The asbestos control program will allow each school district to evaluate the hazard in each school building and to decide on the appropriate abatement action based on the particular circumstances in that school.

A rule probably could not have this degree of flexibility and would most likely be more complicated and expensive than the planned program. The asbestos control program would be consistent, however, with subsequent regulation if such regulation is needed and would ease the implementation of a rule. It will provide EPA with much of the information needed to develop a rule. It will also help prepare those who might be subject to a rule by providing them with technical information and practical experience. In fact, all of the technical support which EPA would give to States in a rulemaking will be given in the asbestos control program.

The Environmental Defense Fund has followed EPA's activities closely and would prefer immediate rulemaking rather than reliance on voluntary compliance. As a consequence, EDF has petitioned EPA to regulate asbestos-sprayed materials under Section 6 of TSCA. There is no dispute that asbestos-sprayed materials can present a serious problem. The concern is over the best approach for solving the problem, and getting on with the job.

EPA has not ruled out the possibility of regulation but has concluded that maximum public health protection can be achieved with an asbestos control program relying on voluntary efforts. The EDF petition is under study and Administrator Costle will respond in the next several weeks.

EDF's petition asks EPA to require under Section 6(a)(7) of TSCA that the manufacturers and processors of asbestos-sprayed materials pay for all or a major part of the abatement actions taken. It is clear that use of Section 6(a)(7) would be extremely controversial and would require resolution of difficult issues.

Under the circumstances rulemaking would undoubtedly be lengthy and, moreover, there is little doubt that such rulemaking would be followed by litigation. The results could be years of delay. In the interim the public health interest may not be served because abatement actions might be delayed pending final resolution of all issues. School districts would be reluctant to pay for abatement actions if there was a chance that someone else would pay for them.

With regard to funding, EPA has been unable to identify any sources of Federal funds within EPA's budget that could help States with the costs of abatement action.

Under the planned asbestos control program it is expected that State and local agencies would bear these abatement costs. How much of an impact this factor will have upon the success of the asbestos control program is uncertain and will depend to a significant extent upon the magnitude of the asbestos problem and local financial situations.

In summary, the Guidance Package should provide State and local officials with all of the information they need to identify asbestos-sprayed materials in schools, to evaluate the hazard, and to take the appropriate abatement action. EPA and HEW personnel will be available to assist, if necessary.

EPA will use the information obtained through its reporting program to evaluate the asbestos control program. This information will also be used as part of EPA's larger program to investigate all uses of asbestos which could lead to further action by EPA, including regulatory action.

Control of friable asbestos-sprayed materials could be a major part of such regulation, particularly if the present asbestos control program does not prove to be adequate.

Thank you. That concludes the prepared portion of my testimony.

[The complete statement of Mr. DeKany follows:]

TESTIMONY OF JOHN P. DEKANY
DEPUTY ASSISTANT ADMINISTRATOR
FOR CHEMICAL CONTROL
OFFICE OF TOXIC SUBSTANCES
U.S. ENVIRONMENTAL PROTECTION AGENCY
PRESENTED TO THE SUBCOMMITTEE ON ELEMENTARY,
SECONDARY, AND VOCATIONAL EDUCATION
OF THE COMMITTEE ON EDUCATION AND LABOR,
HOUSE OF REPRESENTATIVES
JANUARY 8, 1979

Good Morning Mr. Chairman and members of the Subcommittee. My name is John DeKany. I am the Deputy Assistant Administrator for Chemical Control within the Office of Toxic Substances of the Environmental Protection Agency. My Office is responsible for developing the means to control hazardous chemicals under the Toxic Substances Control Act (TSCA). One of the chemicals that we have under active investigation is asbestos. I appreciate this opportunity to describe EPA's activities to control asbestos and in particular our program to control asbestos-sprayed materials in schools. I will begin my discussion with some background on the problem caused by asbestos-sprayed materials and on efforts by the federal government to solve those problems.

From the end of World War II until 1973 asbestos-containing materials were sprayed onto the walls and ceilings, and structural components of numerous buildings, including many schools, in the United States. The asbestos was used primarily for insulation and fireproofing, and in some cases, for decoration. No one knows how many schools contain asbestos-sprayed materials, but it is our best judgment that one to five percent of the schools in this country may contain asbestos. Much of the asbestos-sprayed material is friable, which means that it readily crumbles. As this friable sprayed material deteriorates it releases asbestos fibers into the building's air, and occupants of the building inhale the fibers. Inhalation of asbestos fibers is a well established health hazard because it causes lung cancer, mesothelomia, and other respiratory diseases.

There are three types of actions which schools may take to abate the problem. Schools may remove the asbestos, encapsulate it, or enclose it. Removal is the most effective abatement action, but it generally is the most expensive and is not practical in all situations. Encapsulation refers to the spraying of the asbestos with a sealant or coating which will bind the asbestos fibers. Enclosure refers to placing barriers between the asbestos and the public; the asbestos fibers remain behind the barrier. What abatement action, if any, is needed depends on the particular situation in the building, and the most appropriate abatement action is not always readily apparent.

In 1973, EPA prohibited the spraying of friable materials containing more than one percent asbestos for use as insulating or fireproofing materials. In June, 1978 this prohibition was expanded to cover spraying for any purpose. The EPA regulations were promulgated under the authority of the Clean Air Act to prevent the unsafe introduction of asbestos fibers into the outdoor ambient air.

However, concern over existing problems with indoor air contamination has continued within EPA, particularly in the last year with identification of the school problem. We have held a number of meetings with asbestos industry representatives and the Environmental Defense Fund in an attempt to assess the situation. EPA has retained Dr. Robert Sawyer, one of the nation's few experts on the specific problem of asbestos in buildings, as a consultant. Dr. Sawyer will be addressing this Subcommittee later this morning.

Last October EPA conducted a telephone survey of the States in order to inform ourselves of the status of state programs and to establish contacts with the appropriate public health, education, and environmental departments which have some degree of responsibility for asbestos control within each State. In the fall EPA also established contacts and held meetings with school board associations, the Academy of Pediatrics, the AFL-CIO, and others to take advantage of a wide variety of viewpoints on this difficult subject. These contacts have aided EPA in disseminating information on asbestos in schools and have resulted in a number of articles such as the one recently published in the American School Board Journal. This article presented many of EPA's viewpoint on the problem directly to school administrators.

EPA has also worked with the Department of Health, Education and Welfare (DHEW), which has supported continuing research in this area. In 1977, the Public Health Service issued a bulletin to all local public health officials apprising them of the potential hazard of exposure to asbestos in buildings. In August 1978, Secretary Califano wrote to the Governors about this problem, identifying contacts within DHEW and EPA for further information and assistance. The Secretary's letter placed emphasis on schools and on voluntary action in those schools where hazards exist.

EPA has developed a four-part asbestos control program relying on voluntary efforts by the States and school districts as the best approach for collecting data on the extent of the problem and getting a control program going as soon as possible. The four parts of the asbestos control program are: (1) preparation and dissemination of a Guidance Package, (2) training of field personnel, (3) developing a quality assurance and technical assistance program, and (4) developing a reporting program. EPA is proceeding with these parts simultaneously.

The Guidance Package will consist of two manuals and a reporting form. EPA's telephone survey revealed a need by state and local officials for reliable information on how to identify asbestos-sprayed materials and what to do to control them. These manuals will satisfy that need. The first manual will be a handbook written in nontechnical language. It will explain how to look for asbestos in a school, how to determine what is the most appropriate abatement action, and how to make certain that a contractor performs an abatement action properly. A draft of this manual has been distributed on a limited basis for comment, and the final version should be completed by the end of February.

The second manual is much more technical in nature. It explains in detail how to perform a laboratory analysis for asbestos and what procedures to follow in taking abatement actions. It also explains what federal regulations must be met when taking corrective actions. This manual was published last March by EPA's Office of Air Quality Planning and Standards and is currently available upon request. It will be useful to analytical laboratories and to contractors performing abatement actions.

The Guidance Package will be mailed in March to the Governors, state asbestos program contacts, and every school district in the nation. In addition, EPA will begin a training program to explain how to use the manuals. The training program will be given to EPA's regional Toxic Substance Coordinators, to DHEW regional coordinators, and to state and local officials. EPA has contracted for the production of a videotape which will illustrate the material in the nontechnical manual. Copies of this tape will be made available to state and local officials.

The third part of the asbestos control program is the quality assurance and technical assistance program. EPA will prepare a manual that will specify a procedure for performing bulk analyses for asbestos. State and local officials will be able to use this manual to make certain that the samples that they collect are properly analysed for asbestos.

The final part is the reporting program. A reporting form will be sent to every school district as part of the Guidance Package. School districts will be requested to report to EPA, either directly or by way of a state agency, on the results of their inspection, sampling, and what actions, if any, were taken. These data will enable EPA to determine the full extent of the problem and to evaluate the success of the asbestos control program.

This asbestos program has a number of major advantages. First and most important is that the program can be implemented much faster than a rule can be promulgated. The program will get underway in March when EPA mails a Guidance Package to every school district. Promulgation of a rule would take at least one year because of the need to comply with established regulatory and administrative procedures including the preparation of exposure and economic analyses. A rule could be delayed even longer if challenged legally.

A second advantage of the asbestos control program is that it complements rather than conflicts with existing state programs. Over thirty States have existing programs to control asbestos-sprayed materials, and this number should increase once the Guidance Package is distributed.

EPA is confident that state and local governments will cooperate because they share mutual concern with EPA about protecting the public health. EPA values the cooperation of state and local officials and believes the currently planned program is the best way to obtain it.

A third advantage is the ability to maintain flexibility in order to minimize the cost of taking abatement actions. The problem caused by asbestos-sprayed materials varies greatly from building to building. In some buildings asbestos-sprayed ceilings are intact; in some they are rapidly deteriorating. In some buildings asbestos-sprayed material is readily accessible; in others it is not. The costs of different types of abatement actions also vary significantly. The asbestos control program will allow each school district to evaluate the hazard in each school building and to decide on the appropriate abatement action based on the particular circumstances in the school.

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needed to develop a rule. It will also help prepare those who might be subject to a rule by providing them with technical information and practical experience. In fact, all of the technical support which EPA would give to States in a rulemaking will be given in the asbestos control program.

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With regard to funding, EPA has been unable to identify any sources of federal funds within EPA's budget that could help States with the costs of abatement action. Under the planned asbestos control program it is expected that state and local agencies would bear these abatement costs. How much of an impact this factor will have upon the success of the asbestos control program is uncertain and will depend to a significant extent upon the magnitude of the asbestos problem and local financial situations.

In summary, the Guidance Package should provide state and local officials with all of the information they need to identify asbestos-sprayed materials in schools, to evaluate the hazard, and to take the appropriate abatement action. EPA and DHEW personnel will be available to assist, if necessary. EPA will use the information obtained through its reporting program to evaluate the asbestos control program. This information will also be used as part of EPA's larger program to investigate all uses of asbestos which could lead to further action by EPA, including regulatory action. Control of friable asbestos-sprayed materials could be a major part of such regulation, particularly if the present asbestos control program does not prove to be adequate.

Thank you. That concludes the prepared portion of my testimony.

Mr. **Miller**. Thank you.

STATEMENT OF LESLIE DACH, SCIENCE ASSOCIATE, ENVIRONMENTAL DEFENSE FUND (EDF); ACCOMPANIED BY ROBERT RAUCH, STAFF ATTORNEY, EDF, AND JOSEPH HIGHLAND, CHAIRMAN, EDF'S TOXIC CHEMICALS PROGRAM

Mr. **Dach**. Good morning. I am Leslie Dach, Science Associate with the Environmental Defense Fund. With me today is Robert Rauch, Staff Attorney, EDF, and Joseph Highland, Chairman of EDF's Toxic Chemicals Program.

EDA is a non-profit organization with over 46,000 members dedicated to finding scientifically sound solutions to our nation's environmental problems. We have been involved in a number of issues concerning asbestos and specifically in regard to the issue of concern to us today, as has been mentioned by other witnesses, on December 21, 1978 we petitioned EPA to use its authority under its Toxic Substances Control Act to, (1) promulgate regulations establishing a program designed to identify all public schools in which sprayed asbestos material was used. That program would be funded both by affected school districts and by the manufacturers and processors of asbestos sprayed materials.

The petition also asked EPA to require the manufacturers and processors of asbestos fiber to take appropriate corrective action to eliminate the emission of asbestos from sprayed material in schools. A copy of this petition is appended to the members' copies of this testimony.

We brought this petition for three reasons. One, because we are certain that the levels of asbestos measured in schools clearly present a health risk to students and adults in those schools. Two, because both State, local and Federal action to date has not brought any alleviation of this problem, nor in the foreseeable future is any action likely to occur. And three, because the details of our petition we feel are a reasonable response to this problem that will solve the problem without unnecessary panic, in due course, with sufficient attention paid to economic and other public policy concerns.

Because it is dealt with in detail in our petition, and because of the persuasive testimony we heard this morning from Drs. Sawyer and Nicholson, it is not necessary for us to review all the extensive scientific literature that relates the levels of asbestos measured in schools with cancer. Let me just repeat that the studies have shown that in schools with visibly flaking asbestos, the levels of asbestos in indoor air significantly exceed outdoor levels at times by factor of a hundred.

There seems to have been deliberate confusion here this morning as to whether the levels measured in schools are similar to the levels that have been documented to cause disease.

The first chart on the easel which we have prepared is an attempt to clarify this confusion.

If one looks at the levels of asbestos in school air samples, which is on the far-most right-hand portion of this chart, and compares it with levels of asbestos measured in other situations known to be related to asbestos-caused cancer, for example the homes of workers, occupational exposures, areas downwind from asbestos spray sites, or in the vicinity of asbestos mines and mills, it is clear that these levels overlap. We are talking about in schools the same levels that have been shown repeatedly in the literture to be associated with cancer.

So I think the claims made by the representatives of Johns-Manville that only occupational and para-occupational, whatever that means, exposures have been linked with cancer is simply not borne out by the scientific literature. One doesn't need a separate study for each new factory or each new school that we see this problem in.

We have concepts of environmental carcinogenesis. We have levels that have been measured, that have been associated with cancer. We can extrapolate from these levels the levels we have measured in schools.

Because asbestos has been shown to be a potent human carcinogen, and because as has been mentioned this morning there is no safe level of exposure to asbestos, we are clearly facing a significant health hazard here.

Johns-Manville repeatedly talked about the notion of a dose response relationship. No one here is denying there is such a relationship; that the more asbestos exposure a person receives, the higher the risk. The real issue here is that even at low exposures there is a risk. That is what we are facing in the schools, and that is really the problem that we have to try and abate.

I would like to turn now to a second question which is really what is the extent of this problem nationwide, how significant a problem are we facing.

While complete information on the presence of asbestos material in schools is not yet available, preliminary data does indicate that millions of children and adults throughout the United States are and will be at risk.

As was mentioned this morning, and Johns-Manville has mentioned in previous submissions to EPA, sprayed asbestos insulation was used in a majority of all public buildings constructed between 1940 and 1973.

The information displayed on the next chart is based on an EPA phone survey of fifty States and the District of Columbia. Although as we will describe later very few States have given adequate information, results obtained in the phone survey are nevertheless frightening in their scope.

There are about 90,000 public schools in America. Of these, about 6,000 have been inspected so far. And almost 1,000 of these, over 16 percent, have been found to contained asbestos materials.

This chart shows a bit more detailed account of this situation, in that it lists the States for which we have had inspections of at least 20 percent of the schools.

For example, New Jersey has inspected almost all its schools and about 13 percent contain asbestos. In Indiana, almost half of those schools, 48 percent, so far inspected contain asbestos. In New York City we heard this morning that of the schools inspected nearly 75 percent contain asbestos.

While it is difficult to extrapolate from these numbers to a nationwide estimate of schools containing asbestos, it is illustrative to make some attempt at quantification. And clearly the 1,000 schools identified so far are only the tip of the iceberg.

If we add up the figures for the six States in which 20 percent or more have been looked at, about 15 percent of those schools contained asbestos material. If the actual nationwide percentage is the same, 15 percent, then about 13,000 public schools with over six million students contain asbestos.

This 15 percent figure is probably a fairly accurate one, because it is based here on situations in States where the schools inspected were not completely targeted beforehand for suspicion that they contained asbestos, a fairly wide survey.

But even if the percentage were smaller, let's say it was about a quarter of that, four percent, just an arbitary slicing of what we have seen so far, still about 3500 public schools with almost two million students are exposed or may be exposed to asbestos.

These figures for school children again represent only a part of the population at risk. They don't represent children already graduated from schools and they don't represent children who will enter schools while this problem may continue to recur.

Also the actual population obviously includes various forms of school personnel, such as teachers, administrative personnel, parents, maintenance and custodial staff.

For example, there are over two million teachers currently working in the public schools. So when we add the number of adults onto the number of school children we are talking about millions of people who are currently affected by this situation.

Indeed, representatives of national organizations representing these other populations, for example the National Education Association, the American Federation of Teachers, and the National PTA, have all supported our petition, our call for Federal regulation of asbestos sprayed material. And I am sure that these organizations are looking on with interest at these hearings.

The next issue that comes up is I think we all clearly agree that there is a significant hazard here that applies to a significant number of people, is what has been done about it.

We have heard various witnesses talking about voluntary programs, how successful they will be.

I think if we look at what has been accomplished so far through these voluntary programs we see that actually very little has been done. And that is the real issue.

If we accept there is a hazard here, the question is how do we see results, how do we get those schools cleaned up, what can the Federal government do under existing or new authority to make sure, where it is necessary, exposure to asbestos material is halted.

I would like to just quickly go through a description of what the State and local governments have done so far, because it really isn't very much, it is not enough for us to hang our hats on. And the Federal government must take an active role in increasing the Federal and local efforts to date.

EPA claimed that about thirty States currently have a program that is aimed at controlling asbestos hazards. In the States that made up this thirty figure, we see it is a gross over-estimate of what is actually being done.

For example, included in that program was the State of California. It is listed as having an active program. When we called the State of California to see what an active program meant, it meant that a letter was sent out about two years ago to the various school officials notifying them of the problem. There was no follow-up to see what happened to that letter, did someone read it, did it get thrown away, were there schools that really needed inspections, were there schools that needed abatement action. There was no follow-up, no information given.

We heard again this morning about what occurred in Montgomery County, here in Maryland. We heard of a program that theoretically told us there was nothing to worry about, and upon a later look showed indeed there was a hazard.

So the thirty programs that are listed in the active category, existing category, are not very good.

Also thirty is only part of the States. Let's not forget that leaves twenty states that have no program at all, or a very weak program.

Those States that have no program at all have at least 14 million school children in them who are now completely unprotected, no Federal action at all, no State action that is really going to solve the problem.

The chart now on the easel summarizes what we know about the situation in the 38 States we could get information on.

As you see, 25 States, half the States, have inspected less than one percent of their schools. They don't even know if there is a problem, never mind the more difficult situation of what to do about it.

Thirty-two States have inspected less than twenty percent of their schools. And only three States, three out of fifty, have inspected more than half their schools.

Without inspections there can be no remedial action. Without inspections clearly we don't know who is at risk and the problem is not on its way to being solved.

It is because of the current situation where really nothing is being done that we submitted our petition to EPA. And despite EPA's contentions that a voluntary program, on-going program, is sufficient to handle this problem, we just have to strenuously disagree with that.

Although it is true that rule-making may take longer than a voluntary program, only rule-making can guarantee results. We have seen what has occurred so far with a voluntary program—not much. Sending brochures out is unlikely to really change the situation in any meaningful way.

The poverty of the current State efforts also belies EPA's claims that a voluntary program is good becaue it complements existing efforts. We don't have very many existing efforts. There is really not much there to complement.

Also EPA claims that a voluntary program encourages flexibility while regulation does not. That simply is not true.

First, the claims about flexibility are completely irrelevant to a notion of the inspection and inventory program that is called for in the first part of our petition. In terms of the abatement action, regulation still allows for flexibility. Regulations can provide for a mechanism for a case-by-case determination and for appropriate regulatory action in cases where perhaps the pre-determined stipulation of abatement procedures were clearly inappropriate.

Finally, the voluntary approach fails to provide any financial support for State and local governments.

The rule-making requested by EDF in our petition would, as mentioned, require the manufacturers of asbestos fibers and asbestos sprayed materials to a lesser extent to pay for some of the costs of the inventory and abatement programs. This is really what is needed to get the job going.

We need to force people to act, and we need to begin to give them some assistance, technical and financial, that will enable them to act in a speedy fashion.

I would like to turn briefly to some of the statements that were made by the previous witnesses and just mention what I think are some of the grosser misstatements of facts that we have heard. I mentioned some of them already. The fact that Johns-Manville can continue to insist that there is apparently a no-effect level for exposure to asbestos. This simply is not true. The scientific literature does not support it.

This is not a new issue. The question of a threshold level for asbestos has been looked at by other regulatory agencies, by the courts numerous times. The repeated result, the repeated conclusion in all those forums is that there is no safe level, that even a small level carries with it a risk that must be abated.

Second, Johns-Manville repeatedly claimed that the association between cancer and asbestos only recently came to our knowledge in the late sixties and the early seventies. There has been extensive documentation, extensive development of information on this subject through the numerous court proceedings on worker cases requesting financial settlements from companies for asbestos-related disease. That record clearly shows that Johns-Manville and other asbestos manufacturers knew about this hazard for a long time before the end of the 1960s.

There are numerous other factual misstatements that were made. And I think as Mr. Miller correctly concluded in his remarks, that if one were to look closely at what Johns-Manville had said, if one were to look closely at the scientific information, one would find there was not support for their claims.

I would like to stop here becaue of the time, and we would be willing to answer any questions that you may have.

[The written statement of Mr. Dach follows:]

Environmental
Defense
Fund

1525 18th Street, NW, Washington, D.C. 20036 · 202/833-1484

January 8, 1979

TESTIMONY OF THE ENVIRONMENTAL DEFENSE FUND BEFORE THE SUBCOMMITTEE ON ELEMENTARY, SECONDARY AND VOCATIONAL EDUCATION AND THE HEALTH HAZARD POSED BY ASBESTOS SPRAY MATERIAL IN SCHOOLS

Good Morning. My name is Leslie Dach. I am a Science Associate at the Environmental Defense Fund (EDF). With me today is Robert Rauch, Staff Attorney at EDF, and Joseph Highland, Chairman of EDF's Toxic Chemicals Program. EDF is a non-profit organization with over 46,000 members dedicated to finding scientifically sound solutions to the nation's environmental problems. The Toxic Chemicals Program attempts, through litigation, public education and lobbying to eliminate unnecessary human exposure to toxic chemicals. Specifically in regard to the carcinogenic hazards posed by asbestos, EDF through litigation forced the U.S. Environmental Protection Agency (EPA) to strengthen its regulation of asbestos under the Clean Air Act, successfully petitioned the U.S. Consumer Product Safety Commission (CPSC) to regulate fireplace logs containing asbestos and successfully worked with the Maryland Department of Health and U.S. EPA to reduce the use of crushed rock containing asbestos. On December 21, 1978, EDF petitioned U.S. EPA to use its authority under the Toxic Substances Control Act (TSCA) to regulate the hazard posed by the subject of these hearings--the use of asbestos sprayed materials in schools. A copy of this petition is Attachment A to this testimony. Specifically, the petition requests EPA, pursuant to §6(a)(3), §6(a)(5) and §6(a)(7) of TSCA, (1) to promulgate regulations establishing a program designed to identify all public schools in which sprayed asbestos material is present to be funded by affected school districts and the manufacturers and processors of asbestos fibers and sprayed asbestos material; and (2) to require the manufacturers and processors of asbestos fiber to take appropriate corrective action to eliminate the emission of asbestos fibers from asbestos sprayed-on material.

Because it is dealt with in detail in our petition we will not at this time review the scientific literature indicating that the release of asbestos from asbestos sprayed material into the air of school buildings poses a severe and grave risk to the health of our nation's school children and the teachers, custodians, secretaries, etc. who work in schools.

Let me just repeat that studies have shown that in schools with visibly flaking asbestos material indoor air levels of asbestos significantly exceed typical outdoor levels, at times by a factor of 100. As you can see from the first chart on the easel (adapted from table 3, p. 27 of our petition) the levels of asbestos measured in the air of schools are similar to levels measured in other settings--the homes of asbestos workers, near asbestos mines and mills, and some occupational settings--that have been linked with increased cancer death rates. Because asbestos has been shown to be an exceedingly potent human carcinogen, causing lung cancer and mesothelioma in man after only brief exposures and exposures at low levels, and because there is no safe level for human exposure to asbestos, we are facing a potentially very serious situation.

In our testimony today we will briefly make the following points:

1. asbestos sprayed materials are present in significant numbers

of schools throughout the country;

2. federal, state and local governments have done little, if anything, to solve the problem;

3. EPA has the authority under TSCA to control the problem; and

4. New federal legislation can aid in solving the problem.

While complete information on the presence of asbestos material in schools, nationwide, is not yet available, preliminary data indicates that millions of children and adults, in all areas of the country, are or will be at risk. Asbestos sprayed material was first used in the U.S. around 1935. Use expanded rapidly after World War II and use for fireproofing of structural steel began in earnest in 1958. In 1950 more than half of all multistory buildings constructed in the U.S. used sprayed asbestos material. Johns-Manville, the major U.S. producer of asbestos, has indicated to EPA that sprayed asbestos insulation was used in the majority of all public buildings constructed between 1940 and 1973.

The best information currently available comes from an EPA phone survey of the fifty states and the District of Columbia. In August, 1978, HEW Secretary Califano wrote to the Governors alerting them to the potential hazard posed by schools containing asbestos material. Although, as we will describe in more detail later, only a very few states have systematically surveyed their schools, the results obtained in the phone survey are frightening in their scope.

There are approximately 90,000 public schools in America. Of these only about 6,000 have been inspected. Almost 1,000 of these contain asbestos, over 16%. The situation in individual states also indicates the scope of the problem. The chart now on the easel indicates the situation in states where at least 20% of schools have been inspected. New Jersey has inspected over 2,000 of its 2,400 schools. 265, or over

10% of the schools contain asbestos. In Indiana, 48% of those schools so far inspected contain asbestos. About one quarter of the state's schools have been inspected. Almost all of New York City's 1,000 schools will be inspected by January 31, 1979. Of those inspected to date, about 30% contain asbestos. Massachusetts indicated that 75 schools contain asbestos in a form that could present some risk. Of these 75 more than 20 were classified as being in need of immediate action. Massachusetts has inspected 1400 of its 2400 schools. In Kentucky over 75% of schools inspected, 37 out of 48, contain asbestos. There are 1411 schools in Kentucky. Table 4, pp. 32-33, in the accompanying petition summarizes the data available for all 50 states. (Table 4 is appended to the press copies of this testimony). It is clear that the numbers available to date represent only the tip of the iceberg.

While it is difficult to extrapolate from these numbers to a nationwide estimate of schools containing asbestos, it is illustrative to make some attempt at quantification. Adding up the figures for the six states which have inspected over 20% of their schools, 15% of the schools inspected in those states contained asbestos spray material. If the actual nationwide percentage is also 15%, then about 13,000 schools contain asbestos. The 15% estimate is probably a fairly accurate one because it is based on information from states where the schools selected for inspection were not limited to schools already suspected to contain asbestos.

Even if the percentage of schools containing asbestos is only about one quarter of the 15% rate, i.e. 4%, then approximately 3500 schools, still a shockingly high number, contain asbestos. If one applies the same percentages to the number of children attending public schools, one gets a very crude estimate of the number of children at risk. I want to strongly emphasize the crudity of this estimate, but feel nevertheless that it is worthwhile making it in order to convey the potential magnitude of the problem. Using the 15% figure, about 6 million current school age children are potentially at risk. Using the 4% figure, about 1.7 million are potentially at risk. And these figures represent only this generation of school children, not those already graduated from or about to enter asbestos-containing schools. Moreover, the actual population at risk also includes substantial numbers of adults, teachers, administrative personnel, parents and maintenance and custodial staff. For example, there are over 2 million teachers working in the public schools. Many of these adults actually spend more years in school buildings than do school children. Indeed, the National Education Association, American Federation of Teachers and the National PTA have all called for federal regulation of asbestos sprayed material. I am sure these organizations are looking on with interest at these hearings.

I have tried so far to outline the content and scope of the problem posed by the presence of asbestos containing sprayed material in schools. There should be little disagreement that this issue presents a public health hazard to millions of Americans. Unfortunately, our government agencies, local, state and federal, have done little, if anything, to begin to solve this problem.

U.S. EPA has not exercised its clear legal authority under TSCA despite the health risk documented for you today. Under section 6(a)(3), EPA, by regulation, can require school officials to systematically survey and identify all public schools containing asbestos spray material.

Under §6(a)(7)(A), EPA can promulgate regulations requiring the manufacturers and processors of asbestos fiber and asbestos spray material to pay for this survey. Further, under §6(a)(7)(C), EPA can require, by regulation, that manufacturers and processors of asbestos fiber and asbestos spray material remove or seal the material. As I mentioned, we have petitioned EPA to use this authority. Before filing our petition, we were involved in negotiations with EPA for over half a year. It was EPA's continued footdragging and inaction that led us to formally petition the agency to promulgate the regulations I have just described.

Unfortunately EPA continues to insist that its voluntary program is a sufficient answer to the problem. EPA claims that the voluntary program has the following advantages:

(1) it can begin immediately while rulemaking would take at least a year

(2) it will not antagonize state officials and will take maximum advantage of ongoing state efforts

(3) it maintains flexibility in determining the appropriate abatement action for a given situation

EDF disagrees strongly with all three of these contentions and maintains that a voluntary program will not protect the public from this hazard. While it is true that rulemaking will take longer than simply mailing out manuals to state and local officials, rulemaking will bring about guaranteed results. If past experience is any guide, the voluntary program will yield little results. As I will describe, the current level of state and local efforts is shockingly low. Brochures alone are unlikely to change this situation. The poverty of the current state effort also belies EPA's claim that a voluntary program maximizes use of already ongoing efforts. There simply arent't very many ongoing efforts.

Finally, EPA's claims about increased flexibility are not relevant to the inspection and inventory program called for in the EDF petition. Moreover, regulations can still maintain flexibility in choice of abatement measures. The regulations can provide a mechanism for a case by case determination of appropriate abatement action by allowing schools to apply for such consideration in cases where the predetermined course of action is clearly inappropriate. Finally, the voluntary approach fails to provide any financial support for state and local governments. The rulemaking requested by EDF under §6(a)(7) of TSCA would require the manufacturers of asbestos fiber and asbestos spray material to pay some of the costs of the inventory and abatement programs.

As mentioned, state and local governments have also not acted adequately to protect the public. Few states have embarked on an inspection program that would identify schools containing asbestos. And of those states that have such a program only a small percentage are actually doing anything to correct problem schools. Based on EPA information and our own phone survey, we have begun to ascertain the extent of the inspection and identification efforts.

At least seventeen states--Alaska, Colorado, Idaho, Iowa, Missouri, Montana, Nebraska, Nevada, North Carolina, North Dakota, Ohio, Oregon, South Carolina, South Dakota, Wisconsin and Wyoming--do not have any program to reduce the risk from sprayed asbestos material in schools. There are approximately 14 million public school students in these states. The chart now on the easel summarizes our information for 38 states on the extent of state efforts to control this problem. Twenty-five states have inspected less than 1% of their schools. Thirty-two states have inspected less than 20% of their schools. Only 3 states have inspected more than half of their schools. Clearly, the majority of the nation's school children remain unprotected.

Illustrative of EPA's failure to handle this issue with the concern it deserves and its seeming willingness to downplay the need for action is its characterization of inadequate state programs as "active." This mischaracterization has falsely given the impression that the situation may be adequately resolved without increased federal intervention. For example, EPA has characterized the California program as a "very active" one. Yet the only significant action taken to date was the issuance of a letter, two years ago, by the state officials to individual school districts informing them of the possibility of asbestos related problems in the public schools. No follow-up action has occurred to see whether the schools were ever inspected and if they were to verify that repairs were made where needed. The only information available is that in some 50-100 cases asbestos related problems were detected and in some repairs were performed.

This description of federal and state inaction clearly reveals that the American public is currently left unprotected from the health hazard posed by asbestos containing spray materials in schools. What can be done to rectify this intolerable situation?

As we have already described, EDF has petitioned the EPA to use its authority under TSCA to protect the public health. The agency has not yet responded formally to our petition. EDF plans to use whatever means are at our disposal to persuade EPA to act positively on the contents of our petition. We hope members of this subcommittee will join us in this effort. We will be working with members of Congress and with the national organizations mentioned earlier--American Federation

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of Teachers, National PTA, and National Education Association--to bring pressure on EPA. We will seek court relief if EPA denies our petition. We will also be working at the state and local level, providing technical and political guidance to parents, school administrators, unions, etc. so that they may work with local government agencies to bring about relief. We are confident that the national organizations I have mentioned will provide similar assistance to their members.

Another approach to abating the hazard could take the form of legislation requiring an inventory of schools and abatement measures where necessary. The legislation should establish a fund paid for by the producers and manufacturers of asbestos fiber and asbestos spray material to assist in meeting the cost of these efforts. While EDF feels that TSCA does provide the federal government with the authority to accomplish these objectives, there is no assurance that EPA will use this authority within a reasonable amount of time. In addition, industry is sure to challenge the use of TSCA in court thus further postponing meaningful actions. (Congressional consideration of legislation should not deter EPA from vigorously pursuing its authority under TSCA. Any EPA research or draft regulations developed under TSCA could be used under the new statutory authority.) Passage of legislation specifically aimed at abating the asbestos spray hazard would force the government to act and would greatly shorten the amount of time likely to be spent in litigation. However, in considering such legislation Congress should not create the impression within EPA that the agency need not routinely use its existing authority to regulate chemical hazards in a timely fashion. EPA should not conclude that short of Congressional intervention the Agency is freed of its responsibility to act or that Congress will routinely solve problems that more properly should be solved by EPA.

A precedent for Congress mandating regulatory action on a specific chemical hazard exists in TSCA. Section 6(e) of that Act requires the Administrator of EPA to promulgate rules prescribing methods for the disposal of PCBs, labeling of PCBs, and a ban on manufacturing, processing, and distribution of PCBs. Congress further required that these regulations be promulgated within strict time frames.

The law should require the government to issue regulations requiring identification of all schools containing asbestos. The regulations should be promulgated within 90 days of passage of the Act and be effective immediately upon the date of promulgation. The regulations should require that the inventory be completed within 90 days. The law should also require the promulgation of regulations requiring appropriate remedial action to abate the hazard. The regulations should specify the criteria for selection of the appropriate abatement action and supply a mechanism for a case by case consideration in extraordinary circumstances.

Finally, the legislation should provide for the manufacturers and processors of asbestos fiber and sprayed asbestos material to pay for the majority of the cost of the inventory and necessary remedial action. If this fund cannot be set up in time to assist the schools in meeting the costs of the inventory, then provisions should be made for reimbursement of the schools from the fund once it is established.

The total amount of money that industry should contribute to the fund should be determined on the basis of the estimated total cost of the inventory and abatement actions. EDF does not have such an estimate at this time and hopes that the Committee will generate this information. EDF suggests that state and local governments be required to pay only a small share of these costs, specifically those costs that can be met through the regular and emergency operating and maintenance budgets of the school systems. The remainder should be paid by the industries who manufactured or processed sprayed asbestos material.

Apportionment of the total industry share among individual manufacturers or processors could be determined by one of a number of options. Our preferred approach would be one based on a determination of the amount of asbestos fibers sold by specific companies for use in asbestos spray material and the number of ceilings in which the material was used. The contribution of a company to the fund would be based on their share of this segment of the fiber market. If it is impossible or exceedingly difficult to identify the market shares for fibers sold for spray material, then contributions should be assessed on the basis of overall shares of the total fiber market held by each company during the period sprayed asbestos material was manufactured. Such an approach is based on the joint liabiltiy principle of tort law. EDF does not at this time have any detailed market information. We hope the Subcommittee will develop this information.

We appreciate the opportunity to testify and stand ready to answer any questions you might have.

[The information referred to follows:]

Environmental
Defense
Fund

1525 18th Street, NW, Washington, D.C. 20036 • 202/833-1484

PETITION TO THE ENVIRONMENTAL PROTECTION AGENCY TO CONTROL ASBESTOS EMISSIONS FROM SPRAY-ON MATERIALS WHICH HAVE BEEN APPLIED IN PUBLIC SCHOOL BUILDINGS FOR INSULATION, FIREPROOFING, DECORATIVE OR OTHER PURPOSES

December 21, 1978

OFFICES IN: EAST SETAUKET, NY (MAIN OFFICE); NEW YORK CITY (PROGRAM SUPPORT OFFICE); WASHINGTON, DC; BERKELEY, CALIFORNIA; DENVER, COLORADO

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I. SUMMARY

This petition requests the Environmental Protection Agency to promulgate regulations pursuant to §6 of the Toxic Substances Control Act, 15 U.S.C. §2605, to control asbestos emissions from spray-on materials containing one percent or more asbestos which have been applied in public school buildings for insulation, fireproofing, decorative or other purposes. Specifically, the petition requests the Administrator, pursuant to §6(a)(3), §6(a)(5), and §6(a)(7) of the Toxic Substances Control Act, (1) to establish a program designed to identify all public schools in which these materials have been used (to be funded by affected school districts and the manufacturers of asbestos fiber which has been incorporated into these spray-on materials); and (2) to require the manufacturers and processors of such fiber to take appropriate corrective action to eliminate the emission of asbestos fibers from surfaces which have been sprayed with such materials.

The petition presents evidence which demonstrates that there is a reasonable basis to conclude that the continued exposure to asbestos fibers resulting from the use in public school buildings of such spray-on materials presents or will present an unreasonable risk of injury to health. The petition reviews the extensive evidence which shows that asbestos is a potent human carcinogen and is capable of inducing mesothelioma and lung cancer in the human population even at relatively low levels. The petition also cites evidence which suggests that school children are especially at risk because there is a

generally longer period for the disease to develop than in persons exposed in middle age or later. Finally, the petition points out that teachers or children who smoke are particularly at risk since studies have found that smoking combined with exposure to asbestos substantially increases the possibility of developing lung cancer. Petitioner argues that all of these factors demonstrate that asbestos emissions from these materials present an unreasonable risk to the health of persons using public school buildings.

The petition requests EPA to initiate rulemaking activities pursuant to §6 of the Toxic Substances Control Act by no later than March 1, 1979. Petitioner has also requested that the requirements for an investigation of those public schools which may contain asbestos spray-on materials be made immediately effective upon publication of the proposed rule. In addition, petitioner has requested that corrective action be required immediately in those public schools which have already been identified pursuant to EPA or other surveys and which contain asbestos-laden spray materials which have already visibly deteriorated.

II. JURISDICTION

This petition is filed pursuant to §§6, 11, and 21 of the Toxic Substances Control Act of 1976, 15 U.S.C. §2601 et seq.

Section 21 of the Act, 15 U.S.C. §2620, gives any person the right to petition the Administrator to initiate a proceeding for the issuance of a rule under §§4, 6, or 8, or an order under §§5(e) or 6(b)(2). Section 21(b)(3) requires the Administrator to either grant or deny a petition within 90 days after it has been filed. If the petition is granted, the Administrator is required to promptly commence the appropriate rulemaking proceeding pursuant to §§5, 6, or 8.

Section 6 of the Toxic Substances Control Act gives the Administrator the authority to require by rule a variety of requirements governing, inter alia, the use or disposal of a chemical substance or mixture which he has determined presents or will present "an unreasonable risk of injury to health or the environment. . . ." 15 U.S.C. §2605(a). He is authorized by rule to apply one or more of these requirements to the extent necessary to protect adequately against such risk using the least burdensome requirements. The authority to take the action requested by petitioner is contained in §6(a)(3), §6(a)(5), and §6(a)(7).

Section 6(a)(3) provides that the Administrator may impose "a requirement that such substance or mixture or any article containing such substance or mixture be marked with or accompanied by clear and adequate warnings and instructions with respect to its use, distribution in commerce, or disposal or with respect to any combination of such activities. The form and content of such warnings and instructions shall be prescribed by the Administrator." 15 U.S.C. §2605(a)(3).

Section 6(a)(5) gives the Administrator authority to impose "a requirement prohibiting or otherwise regulating any manner or method of commercial use of such substance or mixture." 15 U.S.C. §2605(a)(5).

Finally, the Administrator is authorized by §6(a)(7) to impose

> a requirement directing manufacturers or processors of such substance or mixture (A) to give notice of such unreasonable risk of injury to distributors in commerce of such substance or mixture and, to the extent reasonably ascertainable, to other persons in possession of such substance or mixture or exposed to such substance or mixture, (B) to give public notice of such risk of injury, and (C) to replace or repurchase such substance or mixture as elected by the person to which the requirement is directed.

15 U.S.C. §2605(a)(7).

Section 11(c) of the Act, 15 U.S.C. §2610(c), gives the Administrator the authority by subpoena to "require the attendance and testimony of witnesses and the production of reports, papers, documents, answers to questions, and other information that the Administrator deems necessary." This section also gives the Administrator the authority upon refusal of any person to obey such a subpoena to initiate an action in the United States District Court to require compliance with the subpoena.

III. DESCRIPTION OF THE PETITIONER

Petitioner, Environmental Defense Fund, Inc. (EDF), is a non-profit, tax-exempt corporation organized under the laws of the State of New York, devoted to the preservation and improvement of the environment. One of the organization's primary goals is the protection of the public against carcinogens and other toxic substances. Through its Toxic Chemicals Program, it seeks to eliminate carcinogens from the air, water, food, and consumer products. The organization has over 45,000 members nationwide, including lawyers, scientists, and other persons committed to the protection of the public health and environment. A substantial number of EDF's members or their children are exposed to asbestos emissions from spray-on materials used in public school buildings. As a result, they face an increased risk of contracting lung cancer or mesothelioma. As such, they are interested persons within the meaning of §21 of the Toxic Substances Control Act. The organization has offices and is doing business at 1525 18th Street, NW, Washington DC; 475 Park Avenue South, New York NY; 1657 Pennsylvania Street, Denver CO; and 2606 Dwight Way (Johnson Hall), Berkeley CA.

IV. SCIENTIFIC BASIS FOR REGULATING ASBESTOS EMISSIONS FROM SPRAY-ON MATERIALS

A. Asbestos Has Been Used Extensively to Decorate, Insulate and Fireproof Schools

Asbestos is a generic term for a number of naturally occurring hydrated silicates that, when crushed or processed, separate into flexible fibers made up of fibrils. A serpentine mineral, chrysotile (white asbestos) and the amphiboles, actinolite, amosite (brown asbestos), anthophyllite, crocidolite (blue asbestos), and tremolite are currently classified as "asbestos".1/

In general, the six asbestiform minerals are commercially useful because they form fibers which are incombustible, and possess high tensile strength, good thermal, acoustical, and electrical insulating properties and moderate to good chemical resistance. These properties made asbestos an attractive material for extensive use in buildings to retard structural collapse during fire, and to provide condensation control, acoustic and thermal insulation, and decorative ceiling coverings. For these uses asbestos was combined with a variety of other ingredients and then sprayed on to the appropriate surface, usually ceilings or internal steelwork and sometimes walls. Spraying offered the advantage of low cost because it allows rapid coverage of large areas, without the need for extensive surface preparation or scaffolding.

A variety of asbestos-containing materials have been used. A study of the use of asbestos materials in New Jersey Schools revealed three basic types of materials.2/ One was a friable (easily crumbled), loosely bonded, mixture of asbestos, mineral wool, clay binders, adhesives, synthetic resins and other proprietary agents. The material was applied by blowing it through a hose, where it passed through a water spray which activated the binders. The material was applied to a one-half inch thickness and then usually covered with a paint sealer. The authors report that material of this type erodes, is easily damaged, and breaks loose from the underlying surface because the binders do not work well. A second type of material consisted of asbestos mixed with other low density minerals such as vermiculite. This material was usually applied in a wet slurry, compacted, smoothed and then painted over. The investigators did not see spontaneous disintegration of this material but in areas accessible to students, the material was often damaged. The third type of material consisted of asbestos mixed with cement or plaster. This was found to have considerable stability and was judged unlikely to allow the spontaneous release of asbestos through erosion. Damage to this type of material from physical contact was seen. All three types of material are classified as sprayed asbestos materials.

The amount and types of asbestos contained in sprayed asbestos insulation and decorative material seems to vary. EPA has reported that material used for decorative purposes contains from 29 to 64 percent asbestos by weight.3/ EPA has indicated that material used for fireproofing and insulation contains from 10 to 80 percent asbestos.4/ Other studies have reported finding material in buildings containing anywhere from 5 to 98 percent asbestos.5/

Chrysotile asbestos appears to be the major asbestiform mineral used. Sometimes amphibole materials are also used, most often in combination with chrysotile.

The use of sprayed material containing asbestos first began in 1932 in Great Britain. The first U.S. use, in 1935, was for decorative and acoustical purposes in a variety of buildings including nightclubs, restaurants and hotels. The use expanded rapidly after World War II. An important additional use, the fireproofing of structural steel and other components of high rise buildings, began in 1958. Noise control appears to have been one of the major reasons for use of asbestos-containing materials in school auditoriums, libraries, hallways and classrooms. Asbestos-containing materials were extremely widely used in this country. In 1950 more than half of all multistory buildings constructed in the U.S. used some form of sprayed mineral fireproofing. Forty thousand tons of sprayed material was used for fireproofing alone in 1968.[5] Jonns-Manville, the major producer of asbestos, has indicated that sprayed asbestos insulation was used in the majority of all public buildings constructed between 1940 and 1973.[6]

Reflecting on the widespread use of asbestos-containing material Robert Sawyer, one of the first scientists to study this issue, concluded,

> "It is indeed possible, therefore, that sprayed asbestos material within buildings may become the most significant source of environmental asbestos contamination in the future."[5]

The major uses of sprayed asbestos material stopped in 1973 when EPA banned spray application of insulating or fireproofing material, but not decorative material, containing more than 1 percent asbestos by weight.[4]

On March 2, 1977 EPA proposed to extend the ban to all uses of sprayed material containing more than 1 percent asbestos.[3] The extension was promulgated on June 19, 1978 (43 FR 26372).

B. Levels of Asbestos in the Air of Schools Containing Asbestos Sprayed Material Far Exceeds Typical Outdoor Air Asbestos Levels

Measurements of air concentrations of asbestos in buildings sprayed with asbestos material for fireproofing, decorative or acoustical purposes indicate indoor levels of asbestos far above those typical for ambient urban and rural air.[7/] The levels found, in some cases 100 times the typical outdoor level, can be expected to lead to asbestos-related diseases.

In general, the presence of asbestos is greatest when there is visible damage to the sprayed material. Under these conditions air levels are the lowest under quiet conditions, when the area treated with asbestos is not being used, but during which asbestos may be steadily falling out from the asbestos-containing material. The highest levels have been measured following damage to the asbestos-containing material or during activities that directly stir up already fallen particles, such as cleaning or student movement.

Table 1 summarizes the results of available studies on asbestos levels in buildings.

For comparison, Table 2 gives the results of two studies measuring chrysotile asbestos levels in the air of 48 U.S. cities during 1969 and 1970. Each value in Table 2 is an average of a number of 24-hour samples and therefore averages peak concentrations.*

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* All the measurements in Table 2 and some in Table 1 are given in nanograms of chrysotile asbestos per cubic meter. A nanogram is one-billionth of a gram. Samples are collected by drawing air through a filter. The asbestos collects on the filter. The sample is mechanically dispersed and prepared for electron microscope examination. All chrysotile asbestos fibers are sized and their mass determined. Using the figures for the air volume sampled and a dilution factor appropriate to the dispersion and preparation technique, the chrysotile mass per cubic meter of air sampled is determined.

Table 1

Airborne Asbestos in Buildings

Sampling Conditions or Nature of Asbestos-Containing Material	Mean Asbestos Levels		Range of Asbestos Levels	
	f/cm^3	ng/m^3	f/cm^3	ng/m^3
1. Schools, N.J.2/				
A. Normal use conditions				
a. fibrous spray				
i. intact				53[a]
ii. damaged				80-1,950
b. cementious				
i. intact				26[a]
ii. damaged				43-280
B. Simulated contact (brushing with hand)			0.0-3.8	
2. Schools, N.Y. 2/				9-135
3. School, Mass.2/				38-260
4. School, Paris, France2/				1-1000
5. University dormitory, UCLA5/ Exposed friable surfaces, 98% amosite General student activities	0.1		0-0.8	
6. Art and Architecture Building, Yale University5/. Exposed friable ceilings, 20% chrysotile				
Fallout				
Quiet conditions	0.02			
Contact				
Cleaning, moving books in stack area	15.5			
Relamping light fixtures	1.4			
Removing ceiling section	17.7			
Installing track light	7.7			
Installing hanging lights	1.1			
Installing partition	3.1			
Reentrainment				
Custodians sweeping, dry	1.6			
Dusting, dry	4.0			
Proximal to cleaning (bystander exposure)	0.3			
General Activity	0.2			

Table 1

Airborne Asbestos in Buildings (Con't.)

Sampling Conditions or Nature of Asbestos-Containing Material	Mean Asbestos Levels f/cm^3	Mean Asbestos Levels ng/m^3	Range of Asbestos Levels f/cm^3	Range of Asbestos Levels ng/m^3
7. Office buildings, Eastern Connecticut[5]				
Exposed friable ceilings, 5 to 30% chrysotile				
Custodial activities, heavy dusting	2.8			
8. Office building, Connecticut[5]				
Exposed sprayed ceiling, 18% chrysotile.				
Routine activity		79		40 to 110
Under asbestos ceiling		99		
Remote from asbestos ceiling		40		
9. Urban Grammar School, New Haven.[5]				
Exposed ceiling, 15% chrysotile asbestos				
Custodial activity; sweeping, vacumming		643		186 to 1100
10. Apartment Building: N.J. heavy housekeeping. Tremolite and chrysotile[5]		296		
11. Buildings, 5 U.S. cities[2]				
a. cementious spray				0.9-180
b. fibrous spray				0-830
c. acoustical & decorative spray				0-160
d. no asbestos				0-42

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a. Only a single sample was taken.

b. 15% of the samples were over 50 ng/m^3; 8% were over 200 ng/m^3

Table 2

Distribution of 24 hour chrysotile asbestos concentrations in the ambient air of U.S. cities

Electron Microscopic Analysis

Asbestos	Mount Sinai School of Medicine		Battelle Memorial Institute	
Concentration (ng/m^3) Less Than	Number of Samples	Percentage of Samples	Number of Samples	Percentage of Samples
1.0	61	32.6	27	21.3
2.0	119	63.6	60	47.2
5.0	164	87.7	102	80.1
10.0	176	94.2	124	97.6
20.0	184	98.5	125	98.5
50.0	185	99.0	127	100.0
100.0	187	100.0	127	100.0

From: Nicholson, W.J. Measurement of asbestos in ambient air, Final Report, Contract CPA 70-92, National Air Pollution Control Administration (1971). And: Office of Technical Analysis, U.S. EPA. A preliminary report on asbestos in the Duluth, Minnesota, area. January, 1974, 33.

As Table 2 indicates, over 98 percent of the samples indicated ambient chrysotile concentrations in the 48 cities to be below 20 ng/m^3. About 80 percent of the samples were below 5 ng/m^3 and about half were below 2 ng/m^3. Only three out of 187 samples were above 20 ng/m^3 and two of these were from cities with a known asbestos source, either a shipyard or brake manufacturing facility. In all three cities, samples taken at other times were below 20 ng/m^3. In most cases, therefore, the maximum concentration of asbestos in urban air was 20 ng/m^3.

Table 1 clearly indicates that asbestos levels in buildings with sprayed asbestos materials can far exceed typical urban levels. For example, levels in one New Jersey school reached 1950 ng/m^3, or about 100 times the maximum typical outdoor concentrations.

The asbestos levels reported for New Jersey schools in entry (1)(A) of Table 1 were taken while the schools were in session, under normal conditions of use. These levels, therefore, illustrate the asbestos levels to which school children and professional personnel are exposed to daily when asbestos-containing material begins to emit asbestos into the air. The schools monitored had visible damage to the asbestos-containing materials in certain hallway or classroom ceilings. The comparison between asbestos levels in areas with intact material and those areas with damaged material demonstrates that the concentration of asbestos increases significantly when the material is damaged. In the New Jersey schools readings in areas with intact material were 26 and 53 ng/m^3 while levels in areas with damaged material ranged from 43 - 1,950 ng/m^3.

The New Jersey schools were also measured for asbestos levels after conditions of simulated abuse of the asbestos material, specifically brushing of the material by hand. Asbestos fibers were measured using the optical microscope and are expressed as fibers per cubic centimeter.* The authors of the study concluded:

> The asbestos air concentrations, during short periods of time, were comparable to those found in occupational settings. Following any such disruption of asbestos during school sessions, normal pupil movement through the hallways could continue to disperse asbestos into the air and it would be expected that the air concentrations would exceed those listed in [Table 1 entry A], where little or no asbestos was visible during the situations sampled.

Table 1 also reports asbestos concentrations in schools in New York, Massachusetts and Paris, France. In all cases asbestos levels significantly exceeded ambient outdoor levels. The levels reported constitute a serious health hazard to all those breathing the contaminated air.

Perhaps the most extensive investigation of asbestos levels in a school building was carried out by Dr. Robert Sawyer on the Art and Architecture Building at Yale University. Dr. Sawyer also used the optical method to measure asbestos fiber concentrations.

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* The optical method is the basis of the Occupational Safety and Health Administration (OSHA) standard for permissible worker exposure to asbestos. The present standard is 2 f/cm^3 averaged over 8 hours and 10 f/cm^3 at any one time. The OSHA standard does not adequately protect worker health and the optical method underestimates the amount of asbestos in the air.

Normal moving of books in the library area of the building resulted in a 15.54f/cm^3 asbestos level. Removal of a 1x2-foot ceiling section resulted in a 17.7f/cm^3 asbestos level. Both of these levels exceed the OSHA 10f/cm^3 standard. The workers removing the ceiling spent only 25% of their actual work time in contact with the ceiling material. Therefore, their exposure levels during contact with the ceiling were higher than the averaged figures recorded above. Asbestos concentrations during other routine activities often exceeded the 2f/cm^3

The following conclusions may be drawn about the magnitude of asbestos air concentrations in buildings with asbestos-containing material:

1. Many asbestos-containing materials have low impact resistance and are easily damaged, resulting in the release of asbestos. Such contact is likely to be routine and unavoidable in schools. It may occur accidently during normal maintenance activities, such as changing of light fixtures, or typical student behavior such as jostling or play activities. (One report indicated extensive damage in a room used for band practice in which the flagpoles used were repeatedly contacting the ceiling). Deliberate vandalism is also common.

2. Physical deterioration of the asbestos material results in airborne asbestos concentrations significantly above the ambient outside level. Levels measured in schools ranged up to 1,950 ng/m^3 and 17.7 f/cm^3.

3. Because damage to asbestos-containing materials is likely to occur in schools, air concentrations significantly above ambient levels can be expected to occur and reoccur in schools with asbestos-containing material.

4. In the absence of physical deterioration, levels can exceed

the maximum asbestos concentration found in most urban air. Moreover, the possibility of future damage to the material and resulting elevated asbestos levels cannot be excluded.

5. Air levels are generally greatest immediately after contact with the asbestos-containing material and during certain routine and custodial work, such as sweeping, that recirculates already fallen asbestos. These levels can exceed the existing inadequate OSHA standard for asbestos exposure and are comparable to levels found in the workplace.

6. Levels of airborne asbestos concentrations are episodic. Contact with the material, level of general activity in an area, or specific custodial tasks greatly affect levels of asbestos. Once asbestos fibers have been released into the air from damaged asbestos-containing material, the fibers repeatedly cause contamination, as disturbance of settled fibers causes resuspension into the atmosphere. Therefore a fiber can participate in repeated cycles of resuspension and settling.

7. Fiber fallout from already damaged material is likely to continue in the absence of repeated contact. Fallout rates are affected by structure vibration, humidity, and air turbulence, and the condition of the adhesive compound.

8. Significant airborne levels can occur without visible asbestos on floors.

C. Asbestos Is a Potent Human Carcinogen, Causing Cancer After Brief Exposures and Low Level Exposures

Asbestos is a potent animal and human cancer-causing agent. It has been shown to cause cancer in a variety of animal species. even after only extremely short exposure periods. For example, Wagner et al.[8/] exposed groups of CD Wistar rats by inhalation to Rhodesian and Canadian chrysotile at a concentration of 12 mg/m^3 respirable dust. Forty-one percent of the animals exposed to the asbestos had cancer. Both mesothelioma and lung tumors were observed. As little as 7 hours of exposure caused neoplasia. In all, about 20 other experiments confirm the link between chrysotile and cancer in animals.[9/]

The evidence linking asbestos exposure to cancer in humans is equally strong. In 1935, Lynch and Smith[10/] first observed that lung cancer was associated with asbestos exposure. It was the early 1950's when epidemiologists conclusively demonstrated the association between certain cancers and exposure to asbestos. Since that time the association has been repeatedly confirmed. For example, Selikoff,[11/] who pioneered in the study of asbestos-related disease, observed that approximately 40 percent of the deaths among asbestos insulation workers in recent years has been due to cancer, compared to less than 20 percent in the general population. In one study of 632 asbestos insulation workers, nearly 4 times as many deaths occurred from cancer as expected (7 times more lung cancer; 3 times more stomach and esophageal cancer; and 3 times more colon cancer than expected). In addition, nearly 8 percent of the deaths among the workers were from malignant mesothelioma of the pleura (lining of the chest) or peritoneum (lining of the abdomen). Mesothelioma is an exceedingly rare, always fatal cancer with nearly zero expectation in the general population. Asbestos workers who smoked cigarettes, had approximately 92 times the risk of dying of lung cancer than did workers of equal age who neither smoked nor worked with asbestos. Asbestos workers who smoked had 8 times the lung cancer risk of other smokers. Selikoff observed similar relationships among other insulation workers and among asbestos factory workers. (The synergistic relationship between smoking and asbestos exposure is particularly relevant to assessing the health hazards of asbestos-containing sprayed material. Obviously, many school children and professionals smoke or will smoke).

McDonald *et al.*[12/] reported an increased lung cancer rate for workers employed in chrysotile mines and mills. Those workers most heavily exposed had about a 5-fold increased risk of lung cancer compared to those least exposed. Kogan *et al.*[13/] reported that male workers in asbestos mills over the age of 50 had a 6-fold increase in lung cancer compared to the general population. Women exhibited a 40-fold increase. An excess in respiratory cancer was described by Wagoner *et al.*[14/] for workers in a major manufacturing complex using predominantly chrysotile asbestos. Similarly, Enterline and Henderson[15/] found that workers exposed only to chrysotile had a respiratory cancer risk 2.4 times that expected.

Similar increases in cancer risks have been found for workers exposed to other types of asbestos or to chrysotile in combination with other types of asbestos. Selikoff *et al.*[16/] found a 7-fold excess of lung cancer in insulation workers exposed to chrysotile and amosite asbestos. Studies by Newhouse and Berry[17/] have indicated an increased mesothelioma rate among workers exposed to mixed asbestos fibers. Additional evidence confirming the association between mesothelioma and asbestos exposure comes from data from Australia, Germany, Italy, Africa, Netherlands and the United Kingdom.[9]

In addition to those workers who work directly with asbestos or asbestos products, Menck and Henderson[18] have suggested a link between increased lung cancer rates and exposure to asbestos among ship and shipyard workers (including stevedores), clothing ironers, plasterers, drywall workers, electricians, and plumbers. In view of the numerous studies on the association between exposure to asbestos and cancer,[9] it is now widely accepted that inhaled asbestos is a potent carcinogen.

Indeed, the U.S. Government has estimated[19] that between 58,000 and 75,000 cancer deaths a year will be attributable to asbestos. This is 13-18% of all cancer deaths expected in the U.S. in the forseeable future, a truly staggering figure.

Epidemiological studies have also shown increased cancer rates among individuals exposed to low levels of asbestos or exposed to asbestos for only brief periods of time. The Wagoner[14] and Newhouse and Berry[17] studies demonstrated increased cancer levels for workers who had worked with asbestos for less than two years. Studies summarized by the International Association for Research on Cancer have shown an association between asbestos and mesothelioma after exposure as brief as one day.[9]

In one of the first studies which demonstrated that brief occupational exposure to asbestos could lead to cancer, Newhouse and Thompson[20] investigated 83 cases of mesothelioma that had occurred over a 50-year period, matching these cases with controls that did not have mesothelioma. A clear association with occupational, domestic and neighborhood asbestos exposure was demonstrated for the mesothelioma cases, and occupational exposures for men were recorded for as little as 5 weeks of exposure, and for women for as little as 6 months of exposure.

In a recent study of 933 men who worked at an amosite asbestos factory, Seidman, Lilis, and Selikoff[21] observed that workers who were employed for less than one month had a slight excess rate of lung cancer, and for those who worked one month, the lung cancer rate was approximately 2.5 times the expected rate. Workers who were employed for less than 3 months experienced nearly a 4-fold increase over that expected for lung cancer after 30 years from onset of work.[11] In a similar study of 246 cases of mesothelioma, Greenberg and Lloyd-Davies[22] found that 12 percent of the cases with occupational exposure had been exposed for under 5 years, and in one case for only 3 weeks.

Epidemiological studies have also demonstrated a correlation between cancer and asbestos exposure for people living in the vicinity of facilities handling asbestos and persons living in the same houses as asbestos workers, people who were likely exposed to levels of asbestos much lower than workers.

Of 87 cases of mesothelioma identified by Wagoner[14] by 1959, the majority of the patients had not actually worked with asbestos.

Indeed, only 12 had industrial exposure. The rest had lived in the vicinity of asbestos mines and mills, some having left the asbestos fields as young children, or in their teens. In some of the cases, the exposure was brief. For example, the youngest case diagnosed, age 21, was apparently only exposed to asbestos for a very brief time as an infant when he was taken to a "cobbing" site by his mother from the age of 6 weeks until he was weaned. In another case, a woman was born in a town on the asbestos fields, left at the age of 5, and was in good health until 55, when she developed pleural mesothelioma.

In the study cited earlier, Newhouse and Thompson[20/] observed that 11 of their 83 mesothelioma cases lived within one-half mile of an asbestos factory, compared to 5 individuals in the control group. Three of the mesothelioma cases, all female, lived within one-half mile of the factory for only 7 years before the age of 14. Of the other 8 cases, one male lived the first 16 years of his life within one-half mile of the factory while 6 of the remaining 7 were females who were between the ages of 6 and 13 years when the factory opened and remained in the area for between 3 and 7 years.

Similarly, Lieben and Pistawka[23/] found that out of 42 cases of mesothelioma investigated, 8 lived or worked in the vicinity of an asbestos plant, while Greenberg and Lloyd-Davies[22/] identified 13 cases (5%) out of 246 cases studied that were associated with exposure by neighborhood or domestic sources of asbestos.

Martischnig et al.[24] found that 58 out of 201 men with lung cancer admitted to a thoracic surgical center gave a history of exposure to asbestos, compared with only 29 of the matched controls, although none were ostensibly "asbestos workers" and none had evidence of asbestosis.

Newhouse and Thompson[20] also identified mesothelioma among persons who lived in the same household as asbestos workers. Twelve percent of the mesothelioma cases (compared to one percent of the controls), involved relatives who lived in the same household with an asbestos worker. In this group, the most usual history of exposure was that of a wife who washed her husband's dungarees or work clothes. The two men in this group, when boys of 8 or 9 years of age, had sisters who were working at an asbestos factory.

Similarly, of the 42 cases of mesothelioma studied by Lieben and Pistawka,[23] 3 were family members of asbestos workers. Further evidence supporting this association was provided by Lillington, Jamplis, and Differding,[25] who reported on a case of a husband and wife who both died of mesothelioma in 1971 and 1973, respectively. The husband worked with asbestos from 1941 to 1949, while the wife's only known exposure was from washing her husband's dusty clothing.

In a recent study, Anderson et al.[26] examined 326 individuals with no occupational exposure to asbestos, but who lived in a family with a member who worked at an amosite asbestos-products factory for varying times between 1941 and 1954. These 326 individuals were clinically examined for prevalence of early asbestos-related health effects, such as the radiographic changes of parenchymal fibrosis, pleural fibrosis, and calcification. The length of employment of the family members in this group who worked in the amosite plant was from one day to 13 years, with 50% of the group coming from households in which the workers' length of employment (and thus active contamination of the home) was less than one year.

Of the individuals examined, all of whom considered themselves to be healthy, 35 percent had chest x-ray abnormalities with a predominance of pleural changes, fibrosis, and/or calcification. Four of the individuals had already developed pleural mesotheliomas. Although it was not possible to predict how many of these individuals with abnormal chest x-rays would eventually develop mesothelioma, the recent study by Edge[27/] suggests the number may be high. Edge observed that of 235 former shipyard workers who had pleural fibrosis and/or calcification on their chest x-rays in 1970, 24% of the 70 deaths that occurred between 1970 and 1973 were from mesothelioma.

The evidence summarized here clearly demonstrates that asbestos in general and chrysotile asbestos in particular is a potent human carcinogen.* Moreover, a "safe" or no-effect level for human exposure to asbestos cannot be determined. This scientific fact must govern any regulation whose goal is to protect the public health from cancer related to asbestos exposure. Only no exposure can guarantee no cancer. The no threshold concept for asbestos and other carcinogens has been accepted by scientists, government regulatory agencies and the courts. For example, the Occupational Safety and Health Admin-

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* In a September 25 letter to Larry Dorsey, Office of Toxic Substances, EPA, Richard Carter, Manager of Government Affairs of the

Footnote continued:

Health, Safety, and Environment Department of Johns-Manville Sales Corporation, cites a recent study, presented to the NY Academy of Sciences, to support Johns-Manville's contention that the level of asbestos measured in schools do not pose a health risk. Our analysis of the study, "Mortality Experience of Residents In the Neighborhood of An Asbestos Plant", by E.C. Hammond et al. indicates that the results do not support John-Manville's claim. Hammond et al. studied the mortality experience of a group of men who lived within one-half mile of an amosite asbestos factory in Riverside, New Jersey. The authors conclude that no increased mortality occurred among the Riverside group when compared to a control group of men who lived in Totowa, N.J., a few miles from the plant. The relevance of this finding to assessing the risks caused by environmental exposure to asbestos is marred by several methodological failings of the study. Indeed, one of the study's author's, William Nicholson, has indicated to EDF that the study is not relevant to assessing the risks posed by asbestos-containing materials in schools.

The study's major failing is that not enough time has passed between the men's exposure to the air around the plant and the time of the study, to allow for the expiration of the expected latency period for development of mesothelioma. The earliest documented residence of a member of Riverside study group near the plant was 1942. The end of the study's follow up period was 1976, 34 years later. The latency period for mesothelioma, even after high occupational exposures is 35-40 years. For mesothelioma associated with neighborhood exposure the latency period is even longer. Newhouse and Thompson[20] reported a latency period of about 49 years for development of mesothelioma after neighborhood exposure. It is simply impossible to conclude that the study cohort did not suffer any asbestos related cancer mortality until at least this period of time has passed since initial exposure. This is especially critical in the context of this petition where the population at risk is children, who can be expected to live upwards of 60 years after exposure to asbestos in schools.

A second problem in interpreting the Hammond study arises from insufficient information about the amount of time a member of the study group lived near the plant. The documentation used in the study was listing in the Paterson city directory twice in the period from 1942 to 1944 and once in the period from 1945-1954. Therefore members of the study group may have been in residence near the plant for as little as three years. Further, there is no information on the percentage of those years actually spent at home.

In summary, the Hammond et al. study does not detract in any way from the overwhelming evidence supporting the association between asbestos induced cancer and the levels of asbestos measured in schools with asbestos-containing material.

istration proposed cancer policy concludes:

> Thus, once a qualitative presumption of carcinogenicity has been established for a substance, any exposure to that substance must be considered to be attended by risk when considering any given population. No exception to this point has yet been demonstrated.....Hence, today it does not seem feasible to predict a "finite" safe level for a carcinogen to an individual human, let alone for a population, composed as we are of aggregates of genetically heterogenous individuals with widely varying predispositions and susceptibilities.28/ (Emphasis added)

Specifically concerning asbestos, the National Institute of Occupational Safety and Health concludes:

> Evaluation of all human data provides no evidence for a threshold or for a "safe" level of asbestos exposure. Based on the available data, no assessment can presently be made concerning the existence of a level of asbestos exposure below which an increased risk of cancer could not be detected.29/
>
> Only a ban on the use of asbestos can ensure complete protection against this mineral's carcinogenic effect.30/

The IARC monograph on asbestos concludes:

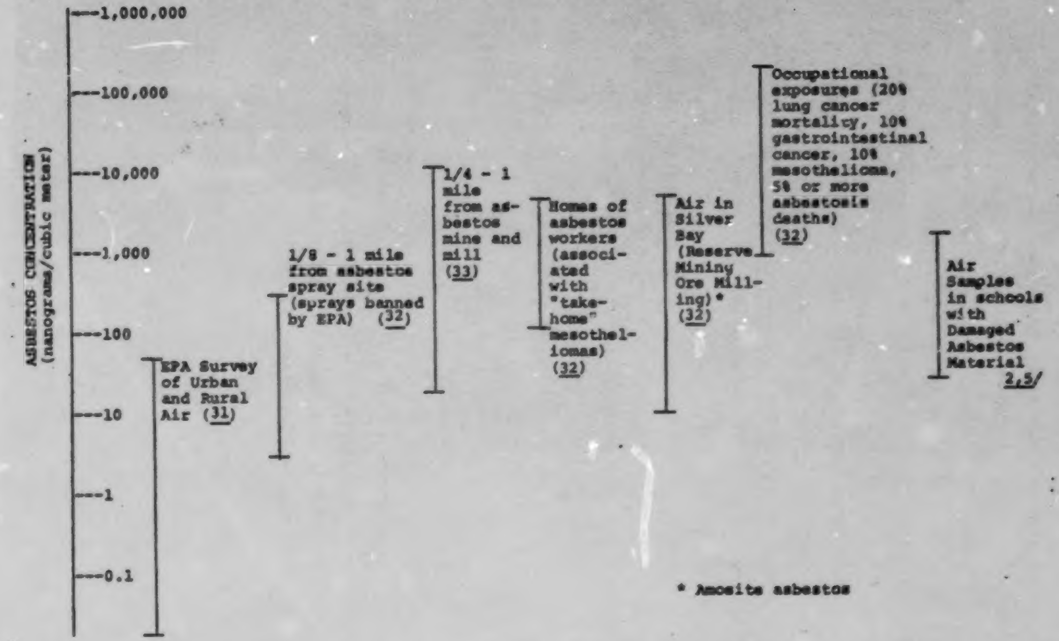
> At present it is not possible to assess whether there is a level of exposure in humans below which an increased risk of cancer could not occur.9/

D. Airborne Asbestos Levels in Schools Are a Significant Health Hazard

On the basis of the above discussion of the absence of a safe level of exposure to asbestos and the scientific evidence demonstrating a clear association between asbestos exposure and various forms of cancer, EDF maintains that any exposure of school children, teachers, custodians or others to asbestos from sprayed material may result in increased cancer rates.

For purposes of illustrating the hazards posed by damaged asbestos-containing material, the levels of airborne chrysotile asbestos concentrations detected in schools is compared in Table 3 to chrysotile concentrations measured in other environments, many of which have been associated with increased cancer rates and asbestosis. Table 3 only includes data from the Environmental Sciences Laboratory at Mt. Sinai School of Medicine. This was done

Table 3 - COMPARISON OF ASBESTOS LEVELS IN SCHOOLS WITH AIR-BORNE LEVELS IN OTHER ENVIRONMENTS SAMPLED BY MOUNT SINAI (chrysotile asbestos unless otherwise noted)



because comparison is most meaningful among measurements analyzed by the same technique. Table 3 clearly indicates that the levels measured in schools are similar to levels observed in the homes of asbestos workers, near asbestos mines and mills, and on the low end of occupational exposures. All these exposures have been linked with increased cancer death rates.

Interestingly, the concentrations of asbestos in schools exceeds the levels measured downwind from asbestos spray sites, a practice recently banned by the EPA. Indeed, in its documentation supporting the ban on sprayed asbestos material containing more than 1% asbestos EPA has publicly admitted the serious health hazards posed by the use of asbestos containing materials in schools. Part of the reason for the ban was EPA's realization that such materials could pose a serious health threat from deterioration after prolonged use. The discussion accompanying the March, 1977 proposal to ban decorative uses of sprayed asbestos-containing material stated this clearly:

> The use of such spray-on materials is considered a major source of asbestos emissions because: .....
> (3) the spray-on materials may deteriorate with time and thereby contaminate the ventilation air when they fall off points of application. 3/

While exposure to asbestos poses a serious health hazard for the general population, the cancer risk faced by children exposed to asbestos is even greater. This is a function of several independent factors.

Children are more likely than adults to survive sufficiently long for the carcinogenic effects of asbestos to be manifested. The lagtime associated with the induction of mesothelioma is typically between 35 and 50 years. The lagtime for cancer is between 20 and 30 years.

Induced neoplasms in school-age children exposed to asbestos from the decay of ceiling materials can be expected to manifest itself when these individuals reach middle age.

In addition, many school children smoke or will smoke cigarettes. Nearly eight million teenagers smoke cigarettes. Twenty-seven percent of teenaged girls smoke. Forty percent of these girls smoke more than one pack a day. Thirty percent of teenaged boys smoke. As noted earlier, Selikoff and co-workers have reported that workers who smoke and who are occupationally exposed to asbestos have 92 times the risk of dying of lung cancer than do workers who did not smoke and have not been exposed to asbestos. Asbestos workers who smoked had 8 times the lung cancer risk of other smokers.

In addition to these factors, children, because of physiological characteristics and activity levels, are at higher risk than adults to the hazards of airborne carcinogens such as asbestos. Children have a higher rate of air exchange and metabolism than adults and consequently exchange a relatively greater volume of air. Thus, per unit body weight, children breathe more air than adults. Under comparable conditions children have been reported to inhale two to three times as much of a pollutant as older people.[34]

Added to this normal difference in air exchange rates is the fact that children are more active than adults. As the level of activity rises, so does the rate of air exchange in the lungs--roughly in an exponential manner. Therefore, children in classrooms where ceiling damage has lead to contamination with asbestos dust, are highly likely to inhale significant levels of contaminated air while playing. Moreover, such physical activity in children is often associated with mouth breathing and consequently with a loss of the body's normal nasal filtering capacity. Further, because children are shorter than adults, they are more likely to come in contact with the asbestos dust that gets stirred up from the floor. Studies on various pollutants indicate a distribution in pollutant concentration as a function of distance from the ground. In one study, lead concentrations were found twice as high 1.5 meters from the floor as 20 meters.[34/]

E. Schools Throughout America Contain Sprayed Asbestos Material

The health hazard posed by the use of asbestos-containing materials in schools affects students and other school personnel throughout the United States.

Detailed information indicating the nationwide scope of this problem comes from an EPA study in early October, 1978.[35] EPA Regional Toxic Substance Coordinators contacted all 50 states to determine the extent of the problem and the state's reactions. Although only a very few states had systematically surveyed their schools to identify those containing asbestos, the results obtained are frightening in their scope.

Nearly a thousand of the approximately 6,000 schools inspected have been identified as containing asbestos. Nearly half the public schools inspected in Indiana (260 out of 542) contain asbestos, and over 1,700 Indiana schools have yet to be inspected. In New Jersey, over 10% of the schools contain asbestos (265 out of 2,444). In many of those schools the asbestos material is visibly damaged. Massachusetts reported 75 of its schools as containing asbestos in a form that could present a risk. Of those 75, more than 20 were so dangerous as to be classified in need of immediate action. In Kentucky, over 75% (37 of 48) of the schools sampled contained asbestos. Table 4 summarizes the data available for all 50 states.

It is difficult to generalize from these numbers to a nationwide estimate of schools containing asbestos. Schools in different parts of the county were built at different times and can be expected to have differed in their use of asbestos material. In addition, the EPA study does not indicate the criteria that led to a school being

Table 4

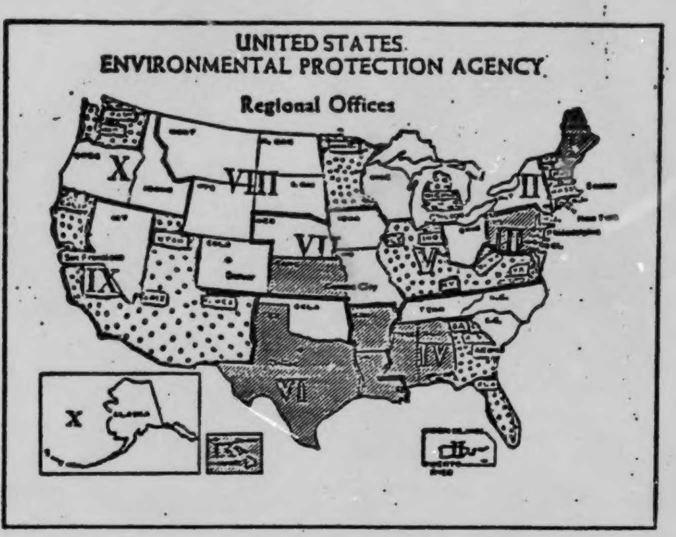
Schools with Asbestos

State	Number of Schools	Students	Number Schools Inspected	Number positive for presence of Asbestos in Material or Air Samples
Alabama	1,370	751,669	1	1
Alaska	349	88,552	0	0
Arizona	806	490,814	some	?
Arkansas	1,183	451,960	0	0
California	7,050	4,613,012	many	30-100
Colorado	1,264	559,405	0	0
Connecticut	1,116	640,255	45	[illegible]
Delaware	300	125,900	few	?
District of Columbia	193	128,095	0	0
Florida	1,985	1,551,538	?	?
Georgia	1,770	1,068,854	few	0
Hawaii	223	178,367	0	0
Idaho	553	182,086	0	0
Illinois	4,512	2,136,329	?	?
Indiana	2,262	1,116,802	542	260
Iowa	1,890	611,059	0	0
Kansas	1,626	442,537	40	0
Kentucky	1,411	682,066	48	37
Louisiana	1,505	809,674	?	?
Maine	815	241,256	3	1
Maryland	1,352	870,974	1	0
Massachusetts	2,425	1,109,874	1,400	75
Michigan	3,894	1,957,774	200	17
Minnesota	1,144	831,226	?	?
Mississippi	1,063	505,342	1	1
Missouri	2,282	950,857	0	0
Montana	799	167,587	0	0
Nebraska	1,865	313,657	0	0
Nevada	260	135,821	0	0
New Hampshire	451	169,022	?	?
New Jersey	2,444	1,429,517	2,000+	265
New Mexico	635	274,473	many	some
New York	4,380	3,381,925	1,050	187
North Carolina	2,023	1,165,964	0	0
North Dakota	795	132,787	0	0
Ohio	4,199	2,260,698	1	?
Oklahoma	1,864	588,540	some	?
Oregon	1,286	456,512	0	0
Pennsylvania	4,036	2,193,022	20	some
Rhode Island	400	176,008	400	19
South Carolina	1,1[illegible]3	601,513	0	0
South Dakota	830	150,045	0	0
Tennessee	1,755	880,145	0	0
Texas	5,291	2,750,161	some	0
Utah	553	308,879	4	some
Vermont	403	104,609	100	?
Virginia	1,781	1,094,136	31+	0
Washington	1,727	780,030	30-50	some
West Virginia	1,274	387,881	some	?
Wisconsin	2,274	961,195	0	0
Wyoming	380	87,586	0	0
TOTAL	87,061		6,333+	973+

inspected, whether it was a random sample or pegged to some suggestion that asbestos was present. However, some attempt to quantify the extent of the problem is illuminating. If the actual percentage is the same as documented in the EPA survey, the number of schools containing asbestos would be about 13,500. If the percentage of schools nationwide containing asbestos is one-quarter the 16 percent rate revealed in the EPA study, i.e. 4%, then approximately 3,500 of the nation's 87,000 schools contain asbestos. If one applies the same percentages to the number of children attending public schools, one gets a very crude approximation of the number of children at risk, if the asbestos in those schools is releasing into the air. Using the 4% figure, about 1.7 million children may currently be at risk. Using the 16% figure, 6.8 million children may currently be at risk. (These figures represent only this generation of school children, not those already graduated from asbestos-containing schools. In addition, if the problem continues unabated, each succeeding generation of school children will also be at risk). The actual population at risk also includes teachers and maintenance and custodial staff. There are approximately 2,178,000 teachers working in the public schools.[36/]

The EPA report also provides information on the number of states that have embarked on a program to identify and correct problems caused by asbestos-containing material. Figure 1 gives a pictoral representation of this information. Nineteen states have no program at all. These are Alaska, Colorado, Idaho, Illinois, Iowa, Montana, Missouri, Nebraska, Nevada, New York, North Carolina, North Dakota, Ohio, Oregon, South Carolina, South Dakota, Tennessee, Wisconsin and Wyoming. There are about 15 million public school students in these states. Ten states have only a sporadic program, which entails only

STATE INVOLVEMENT IN PROGRAMS TO CONTROL ASBESTOS-SPRAYED MATERIAL IN SCHOOLS[15]


UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
Regional Offices
X
VIII
II
I
III
VII
V
IX
IV
VI
X
IX
II

⁙ States with very active programs

▨ States with more moderate programs

○ States without programs *

* Since the time of publication of this map, several states without programs have begun fragmentary efforts.

rare inspections of schools for asbestos. These are Alabama, Arkansas, Kansas, Louisiana, Maryland, Mississippi, Hawaii, Maine, Pennsylvania and Texas. There are about 9 million public school students in these states. Twenty-one states have more active programs. But even these programs have not notified all local school board authorities as to the potential risk and have not inspected a large number of schools for asbestos.

F. To Eliminate the Hazard, the Asbestos Material Can Be Sealed or Removed

There are two long-term approaches to alleviating the health hazard caused by asbestos-containing material.[25/] The first is complete removal of the material. The second is use of a sealant or enclosure to prevent release of fibers into the air.

Enclosure of a sprayed asbestos surface simply means placing an impermeable barrier between the surface and the occupied area. Contact with the asbestos surface is thus avoided and any asbestos falling out by erosion cannot reach the occupied area. Because the asbestos-containing material has not been removed, it must still be dealt with when the building is renovated or demolished. In addition, any break in the barrier will release the asbestos fibers that had accumulated on its upper surface. The sealing of asbestos surfaces involves coating the surface with a material that will form an effective seal against fall-out of fibers from erosion, and will not allow the release of fibers after impact. Again, the problem of dealing with the asbestos material during renovation or demolition remains. The effectiveness of a sealant is also limited by the quality of the bond between the asbestos material and the underlying structural element. A sealant cannot prevent emission of fibers if the asbestos shears off the underlying structural element. Finally, the sealant can be expected to erode with time, at which time asbestos will again enter the environment. EPA has contracted with Battelle Columbus to assess a variety of available products for use as a sealant. This report should be available in the near future.

The choice of control measures is dependent on a number of factors including the characteristics of the asbestos material, how well it is bound to the underlying structural elements, accessibility of the material to impact, and available resources. According to the study of New Jersey schools,[2/] the major cost difference between removing and sealing the asbestos material is the cost of replacing the removed material. Labor costs are similar because both sealing and removal must be done under strict work conditions in order to protect worker health and prevent air contamination that could arise from the contact with the material that is a necessary part of any removal or sealing procedure.

Detailed cost figures for removing or sealing asbestos-containing materials are unavailable. Costs for individual corrective actions are available but it is difficult to extrapolate from the particular situations to a more general cost estimate. EPA has reported a \$13.64/m^2 cost for removal of a ceiling in one documented case.[6/] The New Jersey study estimated a \$1-2/sq. ft. cost for sealing and \$2-5/sq. ft. cost for removal and replacement of an asbestos-containing ceiling.[8/]

V. LEGAL BASIS FOR RULEMAKING UNDER §6 OF THE TOXIC SUBSTANCES CONTROL ACT

A. The Unreasonable Risk to Health Posed by Asbestos Emissions from Spray-On Material Cannot Be Prevented to a Sufficient Extent by Action Taken Under a Federal Law Not Administered by the Administrator.

In the foregoing section, petitioner has demonstrated that asbestos emissions from spray-on coatings in public school buildings may present an unreasonable risk of injury to the health of persons using such buildings. In this section, petitioner will demonstrate that §6 of the Toxic Substances Control Act gives the Administrator the authority to regulate such emissions and that use of that section rather than some other federal law is appropriate.

Once the Administrator has concluded that there is a reasonable basis for regulating the use of a chemical substance or mixture on the grounds that it presents an unreasonable risk of injury to health, he must first determine whether the risk of injury can be prevented or reduced to a sufficient extent by action under another federal law not administered by the Administrator. See §9(a), 15 U.S.C. §2608(a). If the Administrator determines that such risk can be prevented or reduced under another federal statute not administered by him, he is required to submit to the agency which administers such other law a report describing the risk and a summary of the evidence supporting his determination of unreasonable risk.

Petitioner has carefully reviewed other federal laws administered by agencies other than EPA which might be invoked to control asbestos emissions from spray-on materials. Petitioner has concluded that other federal laws not administered by the Administrator could not prevent or reduce to a sufficient extent the risk posed by these asbestos emissions.

There are three other federal statutes which might be utilized to control asbestos emissions from spray-on materials--the Occupational Safety and Health Act, the Federal Hazardous Substances Act, and the Consumer Product Safety Act.

The Occupational Safety and Health Act, 29 U.S.C. §651 et seq., is not applicable for several reasons. First, it does not apply to "the United States or any state or political subdivision of the state." 29 U.S.C. §652(5). Since this petition deals with asbestos emissions in public schools, the Occupational Safety and Health Act would not be able to reach this problem. Second, even if it were construed to apply to public schools, the Occupational Safety and Health Act would protect only school teachers and other employees of the school system. Even if a standard were developed to protect these persons, it is quite possible that such a standard would be inadequate to protect school children who can be expected to live longer than their teachers and therefore have a greater chance of contracting lung cancer or mesothelioma even at very low levels of exposure. In short, the Occupational Safety and Health Act is apparently not applicable to public buildings and limits standards to those needed to protect workers. Its use therefore is not appropriate here.

The Federal Hazardous Substances Act, 15 U.S.C. §1261 et seq., is another federal law which might be used to control asbestos emissions from spray-on material. Section 2(f)(1)(A) of the Federal

3.5

Hazardous Substances Act does cover substances which are found to be toxic, a definition which presumably takes in substances such as asbestos. However, assuming spray-on materials containing asbestos were classified as a hazardous substance, the question remains whether asbestos emissions from these materials could be regulated under §2(q)(1)(A) or 2(q)(1)(B) of the Act. Section 2(q)(1)(A) applies to hazardous substances intended for use by children. Clearly, spray-on materials containing asbestos do not fall into this category. Section 2(q)(1)(B) of the Federal Hazardous Substances Act applies to hazardous substances intended for "household use." It would be difficult to argue that asbestos emissions from spray-on materials used in public schools constituted hazardous substances intended for "household use."[37]

The third and final statute which might be used to control asbestos emissions from spray-on materials and which is not administered by EPA is the Consumer Product Safety Act, 15 U.S.C. §2051 et seq. Unlike the Federal Hazardous Substances Act, the Consumer Product Safety Act is applicable to products used in a "household or residence, a school, in recreation, or otherwise. . . ." 15 U.S.C. §2052(a)(1). However, unlike the Federal Hazardous Substances Act, a "consumer product safety standard shall be applicable only to consumer products manufactured after the effective date [of a rule promulgated pursuant to §7 or 8]." 15 U.S.C. §2058(d)(1). Clearly, a rule under §7 or 8 of the Consumer Product Safety Act would fail to reach the problem presented in this petition--at most such a rule could only apply to asbestos-containing spray-on materials which were manufactured after the effective date of such rule.[38/]

From the foregoing, it should be reasonably clear that the risk presented by asbestos emissions from spray-on materials in public schools could not be prevented to a sufficient extent by action taken under other federal laws not administered by the Administrator of EPA. Therefore, §9(a) presents no barrier to the use of §6.

B. It May Not Be in the Public Interest To Attempt To Use Other Laws Administered by the Administrator To Control Asbestos Emissions from Spray-On Materials in Public Schools.

Section 9(b) of the Toxic Substances Control Act, 15 U.S.C. §2608(b), requires the Administrator to "coordinate actions taken under this Act with actions taken under other Federal laws administered in whole or in part by the Administrator." In addition it states, "If the Administrator determines that a risk to health or the environment associated with a chemical substance or mixture could be eliminated or reduced to a sufficient extent by actions taken under the authorities contained in such other Federal laws, the Administrator shall use such authorities to protect against such risk unless the Administrator determines, in the Administrator's discretion, that it is in the public interest to protect against such risks by actions taken under this Act." Section 6(c) elaborates further on the factors to be considered by the Administrator in making such a determination:

> If the Administrator determines that a risk of injury to health or the environment could be eliminated or reduced to a sufficient extent by actions taken under another Federal law (or laws) administered in whole or in part by the Administrator, the Administrator may not promulgate a rule under subsection (a) to protect against such risk of injury unless the Administrator finds, in the Administrator's discretion, that it is in the public interest to protect against such risk under this Act. In making such a finding the Administrator shall consider (i) all relevant aspects of the risk, as determined by the Administrator in the Administrator's discretion, (ii) a comparison of the estimated costs of complying with actions taken under this Act and under such law (or laws), and (iii) the relative efficiency of actions under this Act and under such law (or laws) to protect against such risk of injury.

15 U.S.C. §2605(c)(1).

The only other federal law administered by the Administrator which conceivably could be used to control asbestos emissions from spray-on materials is the Clean Air Act. EPA has promulgated regulations governing the demolition and renovation of buildings, including public school buildings, which contain such spray-on materials. 43 Fed. Reg. 26372 (June 19, 1978). Among other things, these regulations prohibit the spraying of buildings, structures, structural members, pipes, and conduits with materials containing more than one percent asbestos on a dry weight basis. The regulations, however, only cover emissions of asbestos from spray materials which occur as a result of renovation or demolition of buildings in which these materials have been used. Emissions which result from gradual deterioration of these coatings are not covered by the regulations.[39]

Moreover, although it is never specifically stated, the preamble to these regulations suggests that the legal justification for the regulations is to prevent contamination of either the outside ambient air with asbestos fiber or outside ambient air which enters a building's ventilation system.[40] This suggests that the Agency is not certain whether it has authority under the Clean Air Act to regulate so-called "indoor air pollution." Although petitioner does not necessarily accept this interpretation of the law, it is an argument which could be advanced and which could preclude use of §112 of the Clean Air Act to prevent or reduce to a sufficient extent the risk posed by these asbestos emissions.[41]

Even if the Clean Air Act is construed to enable the Administrator to regulate purely "indoor air pollution," petitioner submits that it is still in the public interest to regulate these emissions under §6 of the Toxic Substances Control Act. The following reasons would support such a finding.

First, unlike the Clean Air Act, the Toxic Substances Control Act permits the Administrator to make new requirements effective upon proposal. Under §112 of the Clean Air Act, the Administrator has a full year in which to propose and promulgate regulations once a pollutant is listed. Moreover, once a regulation is promulgated it cannot apply to existing sources of the hazardous air pollutant until 90 days have passed. As pointed out in the preceding section, a number of the public school buildings addressed in this petition contain spray-on materials which are already badly deteriorated and need immediate attention. Petitioner submits that it is in the public interest to take corrective action in those situations as quickly as possible. The Toxic Substances Control Act would permit this; the Clean Air Act would not.

The second reason it would be in the public interest to use §6 of the Toxic Substances Control Act and not the Clean Air Act to address this problem is that §6(a)(7) of the Toxic Substances

Control Act permits the Administrator to shift the costs of removing the hazardous chemical substance or mixture to the manufacturers of such substance or mixture, rather than imposing the costs on the consumer or user of the substance or mixture. There is no comparable provision in the Clean Air Act. Indeed, under the Clean Air Act EPA would presumably be forced to place the entire burden of correcting the problem on the public school systems themselves. Petitioner, as will be explained below, does not believe that the school systems should bear the entire burden for correcting the problem. Indeed, we submit that the manufacturers and processors of the fiber which went into such materials should bear the primary financial responsibility for correcting the health hazards posed by extensive use in public school buildings of such spray materials.

Finally, it can be argued that the Administrator has considerably more flexibility under §6 of the Toxic Substances Control Act to address the problem than he would have under §112 of the Clean Air Act. Section 112 generally requires the Administrator to set an emission standard, a standard which must provide "an ample margin of safety" for protection of public health. Although the Administrator has recently been given the authority to require design standards where emission standards are not feasible, it is still questionable whether the Administrator would have the authority to either require the use of sealants or to order the removal of the spray-on materials in cases where sealants would not be effective. Arguably, the greater flexibility afforded the Administrator by §§6(a)(5) and 6(a)(7) of the Toxic Substances Control Act would reduce these problems and thus serve the public interest.

In short, even if the Administrator determines that he has the authority to regulate "indoor air pollutants" under the Clean Air Act, it is still in the public interest to utilize §6 of the Toxic Substances Control Act for the reasons outlined above. Therefore, we now turn our attention to §6.

C. Section 6 Gives the Administrator the Authority To Regulate Asbestos and Mixtures Containing Asbestos Used for Spray-On Materials.

Section 6 of the Toxic Substances Control Act gives the Administrator of EPA authority to regulate "the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance or mixture, or . . . any combination of such activities, [that] presents or will present an unreasonable risk of injury to health or the environment. . . ." 15 U.S.C. §2605(a). Asbestos falls within the definition of "chemical substance" since it is an "inorganic substance of a particular molecular identity." 15 U.S.C. §2602(2)(A). Furthermore, spray-on materials containing asbestos are "mixtures" within the meaning of §6--that is "any combination of two or more chemical substances if the combination does not occur in nature and is not, in whole or in part, the result of a chemical reaction." 15 U.S.C. §2602(8). According to the Senate Report, the term "mixture" includes "articles containing chemical substances. . . ." S. Rep. No. 94-698, 1976, U.S. Code Cong. & Ad. News 4491, 4505. Therefore, under §6, asbestos can be regulated either as a chemical substance or as a component of a mixture if "there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use or disposal (of such substance or mixture) presents or will present an unreasonable risk of injury to health or the environment. . . ." 15 U.S.C. §2605(a). The types of evidence and degree of proof required to find unreasonable risk is discussed in the House Report. The House stated that a finding of unreasonable risk "may be based upon items such as toxicological, physiological, epidemiological, biochemical or statistical research or studies or extrapolations therefrom. The finding . . . must include adequate reasons and explanations for the Administrator's conclusion. It does not, however, require the factual certainty of a 'finding of fact' of the sort associated with adjudication." H. Rep. No. 94-1341, 94th Cong., 2d Sess. (1976) at 32.

Although the term "unreasonable risk" is not defined in the Toxic Substances Control Act itself, the courts have interpreted this term in other comparable statutes. For example, in interpreting its use in the Federal Hazardous Substances Act, the District of Columbia Circuit has defined unreasonable risk as involving "a balancing test like that to be made in tort law; the regulation may issue if the severity of the injury that may result from the product, factored by the likelihood of the injury, offsets the harm the regulation itself imposes on manufacturers and consumers." Forester v. CPSC, 559 F.2d 774 (D.C. Cir. 1977). This same test has also been applied to regulatory decisions under the Consumer Product Safety Act involving the same "unreasonable risk" standard. See Aqua Slide 'N' Dive v. CPSC, 569 F.2d 831, 839 (5th Cir. 1978).

Finally, the District of Columbia Circuit Court has used a very similar test in defining unreasonable risk under the Federal Insecticide, Fungicide and Rodenticide Act. In Environmental Defense Fund, Inc. v. EPA, 548 F.2d 998, 1005 (D.C. Cir. 1976), the court stated, "To evaluate whether use of a pesticide poses an 'unreasonable risk to man or the environment,' the Administrator engages in a cost-benefit analysis that takes 'into account the economic, social, and environmental costs and benefits of the use of any such pesticide.' 7 U.S.C. §136(bb)." Perhaps most important, the court has noted that "Reliance on general data, consideration of laboratory experiments on animals, etc. has been held a sufficient basis for an order cancelling or suspending the registration of a pesticide. Once risk is shown the responsibility to demonstrate that the benefits outweigh the risks is upon the proponents of continued registration. Conversely, the statute places a 'heavy burden' of explanation on an Administrator who decides to permit the continued use of a chemical known to produce cancer in experimental animals." EDF v. EPA, supra. See also Environmental Defense Fund, Inc. v. EPA, 510 F.2d 1292, 1302 (D.C. Cir. 1975).

Under §6(c)(1) of the Toxic Substances Control Act, the Administrator is required to consider and publish a statement describing the following factors in making his determination of whether a chemical substance or mixture presents an unreasonable risk: (1) the effects of such substance or mixture on health and the magnitude of the exposure of human beings to such substance or mixture; (2) the effects of such substance or mixture on the environment and the magnitude of the exposure of the environment to such substance or mixture; (3) the benefits of such substance or mixture for various uses and the availability of substitutes for such uses; and (4) reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small business, technological innovation, the environment, and public health.

As discussed at length in the preceding section, asbestos can produce both mesothelioma and lung cancer in humans. Moreover, scientists have yet to establish a threshold for asbestos, that is a level below which no adverse health effects exist. Indeed, the evidence suggests that even very low levels of asbestos can lead to lung cancer if a sufficiently long latency period is available.

As pointed out in the preceding section, significant quantities of asbestos are being released as a result of the deterioration of ceilings coated with these spray materials. Indeed, this conclusion is supported by the Agency's Phase I report entitled, "Asbestos: Sources/Effects Review," quoted above. That report states in part:

> Asbestos was also sprayed on ceilings of many commercial buildings, schools, and apartment houses constructed during this period (1940 to 1970). Here the coating was often used for sound-deadening or decorative purposes. Such ceilings are now found to be deteriorating in many places, releasing large numbers of fibers into the air. 42/ [Emphasis added.]

In another portion of the report, asbestos emissions from such ceilings were described as "a major source of exposure to asbestos." 43/ Indeed, of the major remaining sources of exposure to asbestos evaluated in the report, ceilings coated with asbestos in schools and public buildings were listed as the number one priority for further investigation. 44/

The second factor which aggravates the risks posed by these emissions is the fact that their release into an enclosed area such as a school building virtually guarantees their continued resuspension in the air. This has also been recognized by the Agency in its preliminary report on asbestos.

> Turbulence tends to prolong settling and may resuspend particulates already settled. . . . The durability of asbestos fibers and their characteristic slow settling in the air is seen most dramatically in homes, schools, and buildings where the fibers may become trapped and allow buildup of fiber concentrations that cause ever increasing exposures. 45/

Third, as pointed out in the preceding section, the fact that primarily children are exposed to asbestos emissions from spray-on materials in public schools substantially increases the hazards associated with such emissions since children have a sufficiently long life expectancy to make even low exposures hazardous. Moreover, it should be pointed out that asbestos can accumulate in the lungs and that these spray materials are not the only source of asbestos to which such children can be expected to be exposed. Therefore, to the extent that exposure to multiple sources increases the risk of lung cancer, it can be said that this source of exposure aggravates the existing risk from other sources. Finally, a very large number of school children may be exposed on a continuing basis to asbestos emissions from spray-on materials. Preliminary indications are that several thousand public schools contain asbestos spray materials. Assuming that these school buildings are expected to continue in use for 20 to 30 years, this means that several million children, in addition to thousands of teachers and school employees, are exposed and therefore at risk.

The third factor which the Administrator must consider in making his determination is the "benefits of such substance for various uses and the availability of substitutes for such uses." First, much of the spray material which has been used in public schools in the last 20 years has been used for decorative purposes only. Petitioner suggests that there are many substitutes available for these decorative uses. Moreover, where the spray materials have been used for other purposes, such as soundproofing or fireproofing, petitioner submits that substitutes are also available for these uses. In short, there should be no difficulty finding substitute substances to serve any of the foregoing purposes.[46/]

The final factor which must be considered by the Administrator in making a judgment regarding unreasonable risk is "the reasonably ascertainable economic consequences of the rule, after consideration of the effect on the national economy, small business, technological innovation, the environment, and public health." As discussed in the preceding section, it is difficult for petitioner at this stage to assess the full economic consequences of the proposed rule. It is clear that where spray materials must be removed in order to eliminate the public health hazard because chemical sealants or other solutions will not be effective, the cost may be very high. Nevertheless, it is not clear at this time how much material will actually have to be removed from school buildings because of advanced deterioration or other factors. It is quite possible that a complete survey will demonstrate that much of the potential problem can be solved through the application of chemical sealants, sealant which can be applied at a cost of one to two dollars per square foot.

In short, petitioner submits that asbestos emissions from these spray-on materials do present unreasonable risk of injury under the standards presented in §6(c) of the Toxic Substances Control Act and are therefore subject to regulation under §6(a) of the Act. The fact that such regulations may have an adverse economic impact on asbestos manufacturers, and to some extent public school systems, does not overcome the need for immediate action. Indeed, a recent D.C. Circuit opinion has explicitly addressed the problem of regulating carcinogens, such as asbestos, where

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the economic consequences of regulation may be large. The decision in Environmental Defense Fund, Inc. v. EPA, No. 77-1091, slip op. (D.C. Cir. Nov. 3, 1978) provides one of the best legal analyses of standards to be used in regulating carcinogens by administrative agencies. Although the case involves the regulation of PCBs under the Federal Water Pollution Control Act, which does not require an explicit balancing of costs and benefits, the court did consider the costs of the regulations in making its decision.

The court's analysis began by pointing out that

> . . . court's have traditionally recognized a special judicial interest in protecting the public health, particularly where "the matter involved is as sensitive and fright-laden as cancer." Where the harm envisaged is cancer, courts have recognized the need for action based upon lower standards of proof than otherwise applicable.

EDF v. EPA, supra, at 297-98 (footnotes omitted) (quoting EDF v. EPA (DDT), 465 F.2d 528, 538 (D.C. Cir. 1972)).

The court went on to cite a number of cases where it has upheld regulations based on evidence of carcinogenic effects. Referring to these cases, the court stated:

> These cases demonstrate the inevitable tension attending regulation of carcinogens. Frequently, such regulations have severe economic impact. Indeed, sometimes, as alleged by industry petitioners in this case, such regulations may jeopardize plants or whole industries, and the jobs depending on them. In such circumstances, the temptation to demand that the Agency furnish conclusive proof of carcinogenicity as support for the regulations is great. However, the decision to delegate authority to an agency to control suspected carcinogens is a legislative

> judgment that is not open to question in this Court. Congress' direction to EPA to protect against incompletely understood dangers could not be carried out if we were to adopt the proof requirements advocated by industry petitioners.
>
> What scientists know about the causes of cancer is how limited is their knowledge. The record in this case demonstrates that it may take decades for human exposure to carcinogens to result in cancer; in the meantime, the case for inferring a cancer danger with respect to an incompletely understood substance is vigorously disputed. If regulation were withheld until the danger was demonstrated conclusively, untold injury to public health could result. Accordingly, we find that Congress has allowed EPA to support a prohibition on the basis of strongly contested and merely suggestive proof. We conclude that the evidence in this case is at least suggestive of carcinogenicity and thus supports EPA's decision.

EDF v. EPA, supra, at 56-58 (footnotes omitted).

In short, the fact that the regulations requested by petitioner may impose significant cost does not eliminate EPA's responsibility to protect the public against the risk posed by these emissions. Furthermore, the fact that disease associated with these asbestos emissions may not appear for decades does not preclude the regulation of these emissions since "if regulation were withheld until the danger were demonstrated conclusively, untold injury to public health could result." Id. For all these reasons, petitioner suggests that the courts would uphold regulation of emissions resulting from the use of these spray-on materials as an unreasonable risk under §6 of the Toxic Substances Control Act.

D. EPA Has the Authority Under §6(a)(3), §6(a)(5), and §6(a)(7) To Control the Emission of Asbestos from Spray Materials in Public School Buildings.

The first step in controlling emissions from spray materials containing asbestos found in public school buildings is to identify all those buildings which in fact contain such materials. Petitioner believes that responsibility for identifying such buildings should be shared between the processors and manufacturers of the asbestos fiber which went into the spray materials and the school districts themselves. Petitioner believes that the school districts should be required to go ahead and perform the necessary sampling and analysis subject to reimbursement for all or a portion of the costs by the manufacturers and processors of the fiber which went into the materials. The most desirable approach would be to establish a joint cooperative effort at the outset; however, petitioner recognizes that this may not be possible and urges EPA to require the school districts to move ahead on their own if a joint program cannot be worked out relatively quickly.

Authority to require school districts to undertake such sampling and mark the ceilings or other structural components containing asbestos is contained in §6(a)(3) of the Toxic Substances Control Act. That section provides that the Administrator may impose "a requirement that such substance or mixture or any article containing such substance or mixture be marked with or accompanied by clear and adequate warnings and instructions with respect to its use, distribution in commerce, or disposal or with respect to any combination of such activities. The form and content of such warnings and instructions shall be prescribed by the Administrator." 15 U.S.C. §2605(a)(3). All of these ceilings and structural components containing the asbestos spray materials will ultimately have to be disposed of and marking of such materials prior to disposal is essential to eliminate the unreasonable risk of asbestos emissions which may result from such disposal activities. Moreover, as pointed out in the previous section, there is evidence that normal activity associated with the use of areas sprayed with such materials can produce relatively high emissions of asbestos. For example, the installation of track lighting systems in the Yale Architectural Building produced relatively high concentrations of asbestos. The first step in preventing such exposure is to make certain that all such materials are marked in order that adequate precautions can be taken. This is particularly true in the interim period prior to such time as the ceiling is removed altogether or permanently sealed with a chemical sealant.

Legal precedent for the application of the requirements contained in §6(a)(3) to public schools which are in possession of toxic substances is contained in the Agency's regulations issued pursuant to §6(e)(1) of the Toxic Substances Control Act requiring the marking of products and equipment containing PCBs. 47/ Although these regulations were issued pursuant to §6(e)(1) of the Toxic Substances Control Act, they rely on language which is exactly the same as that contained in §6(a)(3). Section 6(e)(1) of the Act requires "Within six months after the effective date of this Act the Administrator shall promulgate rules to--(A) prescribe methods for the disposal of polychlorinated biphenyls, and (B) require polychlorinated biphenyls to be marked with clear and adequate warnings, and instructions with respect to their processing, distribution in commerce, use, or disposal or with respect to any combination of such activities." 15 U.S.C. §2605(e)(1). Needless to say this language precisely tracks that contained in §6(a)(3).

Significantly, the PCB marking regulation "applies to all persons who manufacture, process, distribute in commerce, use, or dispose of PCBs including local, state, and Federal governments."[48] Section 761.20 of the regulations requires anyone possessing certain types of equipment containing PCBs to label such items by July 1, 1978.[49] Petitioner submits that this requirement is very similar to the one proposed herein--that is, the user of a product or entity suspected to contain a toxic chemical was required to first determine whether the chemical was present and then label the product or entity if the finding was positive.

Authority to require the manufacturers and processors of asbestos used in these spray materials to participate in the investigation phase is contained in §6(a)(7). That section provides that the Administrator may impose "a requirement directing manufacturers or processors of such substance or mixture (A) to give notice of such unreasonable risk of injury to distributors in commerce of such substance or mixture and, to the extent reasonably ascertainable, to other persons in possession of such substance or mixture or exposed to such substance or mixture. . . ." 15 U.S.C. §2605(a)(7). Read together, these two provisions clearly give EPA the authority to require school districts in possession of such spray materials and manufacturers and processors of the asbestos which went into them to participate in a program designed to determine which school buildings contain asbestos spray materials. Such a program would involve taking samples from materials which are suspected of containing asbestos and then analyzing those samples for asbestos in an accredited laboratory. To the extent that such survey work has already been performed under previous programs, the Administrator would be empowered to exempt certain states or portions of states from this requirement if he is satisfied that such data was adequate to determine the extent of the hazard.

Once the school buildings containing such materials have been identified and marked, the next step is to either permanently seal or remove altogether the spray material. Authority to require manufacturers and processors of the asbestos which went into these spray materials to remove them or chemically seal them is contained in §6(a)(7)(C). That section gives the Administrator the authority to impose "a requirement directing manufacturers or processors of such substance or mixture . . . (C) to replace or repurchase such substance or mixture as elected by the person to which the requirement is directed." 15 U.S.C. §2605(a)(7)(C). Pursuant to this section, petitioner requests the Administrator to require manufacturers or processors of such fiber to replace or repurchase, but in any event to remove, such spray coatings from those buildings which contain spray materials which have deteriorated beyond the point where chemical sealants could be expected to be effective. Where sealants would be effective, the manufacturers and processors would be required under §6(a)(5) and §6(a)(7) to apply the sealants under the provision that requires the Administrator to impose the least burdensome requirements to correct the problem whenever possible.[50] The determination of whether physical removal pursuant to either repurchase or replacement would be required would be left up to the Administrator or his designee.

Needless to say, tracing particular shipments of asbestos fibers to ultimate use in spray materials in individual buildings will be an extremely difficult if not impossible task. Petitioner submits that Congress never intended that EPA be required to do the impossible to carry out the intent of the statute. Indeed, petitioner submits that joint liability principles from tort law can be applied here to resolve the problem of apportioning the cost of removal among various manufacturers of fiber. Specifically, petitioner suggests that each manufacturer of asbestos fiber be required to pay a percentage of the total removal cost based on the approximate share of the fiber market which such company held during the period of 1950 to 1965. Petitioner submits that this approach is justified by tort cases, such as Hall v. DuPont, 245 F. Supp. 353 (E.D.N.Y. 1972), where the court stated that "many diverse cases impose joint liability on groups whose actions create unreasonable hazards of risk of harm, even though only one member of the group may have been the 'direct' or physical cause of the injury." Id. at 372. The court held in that case that joint liability could lie if "plaintiffs can submit evidence that defendant, acting independently, adhered to an industry-wide standard or custom with regard [to the product at issue, in that instance blasting caps]." Id. at 374. To the extent that every asbestos manufacturer sold raw fiber, some of which ended up in the spray materials, petitioner suggests that the courts would be willing to apportion liability based on a marketshare evaluation, absent other evidence which would defeat the presumption that relative marketshare is a good indicator of relative liability.

Finally, petitioner submits that whether a manufacturer elected replacement or repurchase under §6(a)(7), it would still be required to physically remove the product in a safe manner from affected school buildings. Repurchase, unless specifically limited to a mere refund, clearly contemplates the physical return of the goods. In this case, obviously the possessor of the good, that is the school system, is in no position to return the good itself. Removal of spray materials containing asbestos is a hazardous operation and can only be undertaken safely by professionals. Furthermore, return of the goods is essential to eliminate the hazard. Under §6(a) the Administrator has broad authority and may apply one or more of the listed requirements "to the extent necessary to protect adequately against such risk." In this case, merely permitting manufacturers to refund the price of the spray materials or the asbestos fiber in them would clearly not be adequate to protect against the risk imposed by such materials. In this case, removal of the material and its physical return and ultimate disposal is essential to protect the possessor of the material.

In short, petitioner submits that the Administrator does have the authority under §6(a)(7) of the Toxic Substances Control Act to require the removal of spray materials which have already begun to deteriorate and cannot be effectively sealed.

E. Section 6(d)(2) of the Toxic Substances Control Act Gives the Administrator the Authority to Make Rules Effective upon Publication.

Under §6(d)(2)(A) the Administrator may "declare a proposed rule under subsection (a) to be effective upon its publication in the Federal Register and until the effective date of final action taken, in accordance with subparagraph (B), respecting such rule if (i) the Administrator determines that--(I) the manufacturer, processing, distribution in commerce, use, or disposal of the chemical substance or mixture subject to such proposed rule or combination of such activities is likely to result in the unreasonable risk of serious or widespread injury to health or the environment before such effective date; and (II) making such proposed rule so effective is so necessary to protect the public interest. . . ." 15 U.S.C. §2605(d)(2)(A).

Petitioner submits that asbestos emissions from seriously deteriorated spray materials could very well result in an unreasonable risk of injury to health during the period needed to promulgate regulations. Several studies suggest that even brief periods of exposure may have been responsible for the development of mesothelioma or lung cancer affected individuals many years later.[51] Badly deteriorated ceilings present the possibility of episodic exposures to very high levels of asbestos. Petitioner submits that the possibility of such episodic exposure to very high levels during the period between publication and promulgation of rules is sufficient reason to require that the proposed rules, at least as they apply to buildings with visible deterioration, be effective upon publication in the Federal Register. At a minimum, school districts either alone or in conjunction with manufacturers and processors should be required to begin the requested nationwide survey of school buildings immediately upon publication of the proposed rules.

VI. CONCLUSION

Asbestos emissions from ceilings and other structural components of school buildings which have been coated with spray materials containing this mineral pose an unreasonable risk of injury to school children and other persons using such buildings. Immediate action to identify the sources of such emissions and to eliminate them either through use of chemical sealants or physical removal of the spray material is essential. Section 6 of the Toxic Substances Control Act provides EPA with the necessary legal authority to do so.

Although the Administrator has a maximum of 90 days in which to make a decision on this petition, petitioner requests that a decision be made by no later than March 1, 1979 due to the serious nature of the problem. Petitioner also requests that the Administrator and the Assistant Administrator for Toxic Substances meet with representatives of petitioner as soon as possible to discuss this petition.

Respectfully submitted,

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FOOTNOTES

1. 40 FR 47652

2. Nicholson, W.J. (1978). Control of sprayed asbestos surfaces in school buildings: a feasibility study. Report to the National Institute of Environmental Health Sciences.

3. 42 FR 12122

4. 38 FR 8820

5. Sawyer, F.N. and C.M. Spooner (1978) Sprayed asbestos-containing materials in buildings: a guidance document. U.S. Environmental Protection Agency. EPA-450/2-78-014 (OAQPS No. 1. 2-094)

6. Dorsey, Larry. Asbestos in schools and other buildings. U.S. Environmental Protection Agency. Draft.

7. The information in this section is summarized from references 2 and 5.

8. Wagner, J.C., Berry, G., Skidmore, J.W. and Timbrell, V. (1974) The effects of the inhalation of asbestos in rats. Brit. J. Cancer, 29: 252-269.

9. IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man: Asbestos, Vol. 14 (1977).

10. Lynch, K.M. and W.A. Smith, (1935) Pulmonary asbestosis III: carcinoma of the lung in asbestos - silicosis. Am. J. Cancer 24: 56.

11. Selikoff, I.J. (1976) Asbestos disease in the United States. Rev. fr. Mal. Resp. 4: 7-24.

12. McDonald, A.D., Magner, D. and Eyssen, G. (1973) Primary malignant mesothelial tumors in Canada, 1960-1968. A patholgic review by the mesothelioma panel of the Canadian Tumor Reference Centre. Cancer, 31: 869-876.

    McDonald, J.C., Becklake, M.R., Gibbs, G.W., McDonald, A.D. and Rossiter, C.E. (1974). The health of chrysotile asbestos mine and mill workers of Quebec. Arch. Environm. Hlth., 28: 61-68.

13. Kogan, F.M. Guselnikova, N.A. and Gulevskaya, M.R. (1972) The cancer mortality rate among workers of asbestos industry of the Urals. Gig. i Sanit. 37: 29-32.

14. Wagoner, J., Johnson, W.M. & Lemen, R. (1973) Malignant and Non-malignant Respiratory Disease Mortality Patterns Among Asbestos Production Workers. In: Congressional Record - Senate Proceedings and Debates of the 93rd Congress, First Session, 119, part 6, Washington, D.C. U.S. Government Printing Office, S-4660-S-4662.

15. Enterline, P.E. and Henderson, V. (1973) Type of asbestos and respiratory cancer in the asbestos industry. Arch. Environm. Hlth., 27: 312-317.

16. Selikoff, I.J., Hammond, E.C. and Seidman, H. (1973) Cancer Risk of Insulation Workers in The United States. In: Bogovski, P., Gilson, J.C., Timbrell, V. and Wagner, J.C., eds, Biological Effects of Asbestos, Lyon, International Agency for Research on Cancer (IARC Scientific Publications No. 8), pp. 209-216.

17. Newhouse, M.L. and Berry, G. (1976) Predictions of mortality from mesothelial tumors in asbestos factory workers. Brit. J. Industr. Med., 33: 147-151.

18. Menck, H.R. and Henderson, B.E.(1976) Occupational differences in rates of lung cancer. J. Occ. Med. 18: 797-801.

19. National Cancer Institute, National Institute of Environmental Health Sciences, and National Institute of Occupational Safety and Health. September 15, 1978. Estimates of the fraction of cancer in the United States related to occupational factors.

20. Newhouse, M.L. and Thompson, H. (1965) Mesothelioma of Pleura and Peritoneum Following Exposure to Asbestos in the London Area Brit. J. Industr. Med. 22: 261-69.

21. Seidman, H., Lilis, R. and Selikoff, I.J. Short-term asbestos exposure and delayed cancer risk. Presented at the 3rd In. Symp. on Det. and Prev. of Cancer, New York, April 26-May 1, 1976.

22. Greenberg, M. and T.A. Lloyd-Davies (1974) Mesothelioma register 1967-68. Brit. J. Ind. Med. 31: 91-104.

23. Lieben, J. and Pistawka, H. (1967) Mesothelioma and asbestos exposure. Arch. Environ. Hlth. 14: 559-63.

24. Martischnig, K.M., Newell, D.J., Barnsley, W.C., Cowan, W.K., Feinmann, E.L., and Oliver, E. (1977) Unsuspected exposure to asbestos and bronchogenic carcinoma. Brit. Med. J. 1: 746-749.

25. Lillington, G.A., Jamplis, R.W., and Differding, J.R. (1974) Conjugal malignant mesothelioma. New Eng. J. Med. 291: 583-4.

26. Anderson, H.A., Lilis, R., Daum, S.M., Fischbein, A.S., and Selikoff, I.J. (1976) Household-contact asbestos neoplastic risk. Ann. N.Y. Acad. Sci. 271: 311.

27. Edge, J.R. and Choudburg, S.L. (1978) Malignant mesothelioma of the pleura in Barrow-in-Furness. *Thorax* 33: 26-30.

28. 42 FR 54167

29. National Institute for Occupational Safety and Health (1976) Re-examination and update of information on the health effects of occupational exposure to asbestos.

30. Memorandum to Morton Corn, Assistant Secretary of Labor for OSHA from Director, NIOSH, December 15, 1976.

31. Nicholson, W.J. and F.L. Pundsack (1973) Asbestos in the environment. In: Bogovski, P., Gilson, J.C., Timbrell, V. and Wagner, J.C., eds, *Biological Effects of Asbestos*, Lyon, International Agency for Research on Cancer, pp. 126-130.

32. Nicholson, W.J., Rohl, A.N. and Weisman, I. (1975) *Asbestos Contamination of the Air in Public Buildings*, EPA Contract No. 68-02-1346, Washington, DC.

33. Nicholson, W.J. May 9, 1977, personal communication.

34. Kane, D.N. (1976) Bad air for children. *Environment* 19: 26-34.

35. Johnson, Kirk (1978) State programs to control exposure to asbestos-sprayed material in U.S. school buildings. U.S. Environmental Protection Agency.

36. Jim Ward, American Federation of Teachers, November 29, 1978, personal communication.

37. The Acting General Counsel of the Consumer Product Safety Commission, in a letter dated August 23, 1978 to Mr. Richard Denney, Associate General Counsel of the Environmental Protection Agency, has taken essentially the same position. "Under the FHSA, the Commission lacks jurisdiction to address risks of injury for substances not intended for use in households. Therefore, to the extent the asbestos-containing product in question is used in buildings other than homes, action under the FHSA would not prevent or reduce to a sufficient extent the risk of injury." Letter, supra, at 4.

38. The Acting General Counsel of the Consumer Product Safety Commission, in the same letter quoted above takes essentially the same legal position:

> The effect of such a rule (pursuant to §8) when promulgated is to prevent the manufacture for sale, offering for sale or distribution of a hazardous product. Section 8 rules may be written to have retrospective effect as to products in the chain of distrubution, but generally cannot reach products which have, as of the effective date of the rule, been sold or distributed to consumers.

Letter, supra, at 3 (emphasis added).

39. This fact has been acknowledged by EPA in a draft report entitled, "Asbestos: Sources/Effects Review," prepared by the Assessment Division of the Office of Toxic Substances, dated December 8, 1978.

40. See 42 Fed. Reg. 12122 (Mar. 2, 1977) and 43 Fed. Reg. 26372 (June 19, 1978).

41. It is petitioner's understanding that the State of New Jersey has filed a petition pursuant to the Clean Air Act requesting the regulation of asbestos emissions from spray-on materials. Petitioner urges the agency to give this New Jersey petition serious consideration. The use of §112 requires a difficult legal judgment, and petitioner has urged use of §6 of TOSCA primarily because it believes legal uncertainties may delay the imposition of requirements under the Clean Air Act. Nevertheless, the potential for using the Clean Air Act should continue to be explored.

42. EPA, "Asbestos: Sources/Effects Review," supra note 39 (emphasis added).

43. Id. at 14.

44. Id. at ii.

45. Id. at 10.

46. EPA itself has recognized the availability of substitutes for all these uses. See 43 Fed. Reg. 26372.

47. See 43 Fed. Reg. 7150 (Feb. 17, 1978).

48. Id. (emphasis added).

49. Id. at 7159.

50. See §6(a), 15 U.S.C. §2605(a).

51. See IARC Monographs, supra note 9.

Mr. MILLER. Mr. Kildee.

Mr. KILDEE. Just one question at this point. On your charts there, Mr. Dach, and your percentages of schools with asbestos, is that all use of asbestos or just the sprayed asbestos?

Mr. DACH. As far as we know, that is the sprayed asbestos. But it would include both the friable and cementitious forms of asbestos. And it may in some situations include asbestos that is around pipes or covered by ceilings.

Part of the problem here, as was mentioned by earlier witnesses, is that in the inventories and studies done to date, we simply have no quality control. We really don't know where the asbestos is, whether this is an accurate determination, even for the numbers we have.

Mr. DEKANY. I would like to address that question as well. I would like to qualify the survey, because it has been quoted quite often today.

First of all, there was no voluntary program at the time we took our survey this fall. The only document the States had available to them was Secretary Califano's letter. And basically this was a quick and dirty survey conducted by my staff, calling various States at relatively low levels of management to determine primarily how many States have responded to Secretary Califano's letter a month earlier; how much interest was there in a voluntary program whereby EPA would provide technical help; and what, if anything, States were doing about it.

I am particularly encouraged by the number of States that indicated interest in our helping them in terms of minimal technical guidance and consulting.

As far as the actual percentages of schools containing asbestos, I think our best analysis would indicate that the sample is probably biased, because most of the States had not conducted complete surveys. Undoubtedly they went to those schools which they suspected might have contained asbestos. So it may be biased on the high side.

Our best judgment in talking this issue over with Dr. Sawyer is that perhaps around one to five percent of the nation's schools may contain asbestos.

I might also add were we to put other States on that chart—for example, in Viginia 31 schools were surveyed and no asbestos was found. In one other State, and I have it here in front of me, a hundred percent of the schools had asbestos. For example, in Connecticut, they surveyed 45 buildings and found asbestos in all 45 buildings. I think it would not be wise to assume every school in Connecticut had asbestos.

My point is not to argue with EDF. The main point I am trying to make is that we should not attach at this point too much credibility to that survey, either in terms of the scope of the problem or the cooperation of the States. And I think we in EPA agree with EDF that there are certainly hazardous conditions in many schools, and our current point of view is that we need to get on with the job right now with a voluntary program. We have not said that we have dismissed regulations. In fact, our next chore in my office will be to very carefully analyze the EDF petition.

Mr. **Kildee**. In your survey, did you distinguish, in asking your question, between the type of asbestos, or asbestos in general. When they replied, were they replying for sheet rock type asbestos.

Mr. **DeKany**. We tried to ask the question in a way to make sure they understood we were looking for friable asbestos. However, we cannot be sure that the people we were talking to thoroughly understood the problem. Because, as I said, it was a quick and dirty telephone survey. In fact, I cannot say we reached the most knowledgeable persons in all of these States.

Mr. **Kildee**. That is all at this time, Mr. Chairman.

Mr. **Miller**. Mr. Buchanan.

Mr. **Buchanan**. Do we have, Mr. Chairman, the article published in the American School Board Journal which is mentioned on page four of your written testimony? Could we obtain that if we don't have it?

Mr. **DeKany**. I would be delighted to furnish you a copy of that School Board Journal article, if that is the question.

[The article referred to appears at the end of today's hearing.]

Mr. **Buchanan**. Also the Califano letter that went out, unless we already have it.

Mr. **DeKany**. Yes, we would be delighted to furnish that also.

Mr. **Buchanan**. Now, when you acted, as your testimony indicated, in 1973 and 1978, what was the legislative authority for your action? This is not a hostile question. I am just trying to find out if you have what you need in terms of legislative authority.

Mr. **DeKany**. In 1973, the basis of our rule-making?

Mr. **Buchanan**. Yes. And 1978.

Mr. **DeKany**. In 1973, the basis for our rule-making was the Clean Air Act as amended at that time, which I assume was the 1970 amendments. I am not representing the Clean Air programs, but rather the Toxic Substances program. But it is my understanding that the Clean Air Act effective at that time gave EPA responsibility for protecting ambient outdoor air against the asbestos hazard.

Mr. **Buchanan**. Outdoor air.

Mr. **DeKany**. Outdoor air, that is right, sir.

So the regulations at that time protected or prohibited further installation of asbestos-sprayed materials. At the same time there was a companion regulation that took care of the demolition of buildings. That is one thing that has not been brought up. There is a hazard in a building when it is demolished too from the standpoint of outdoor air.

Another point is, these schools eventually have to be handled in a manner we are talking about. In other words, you just do not take a wrecking ball to a building and tear it down. In the long term, some action such as we are proposing will have to be taken in every building that contains asbestos. In other words, there will be added cost. The problem is there. Added cost will have to be factored into demolition plans in the future. So if you defer the payment now you pay for it later.

Mr. **Buchanan**. Your present authority would extend to indoor as well as outdoor. Is there any gap here legislatively in terms of your having clear foundation from which to move?

Mr. **DeKany**. Again, sir, I am an engineer so I would like to defer that question to our legal staff. We would be happy to provide the committee with a detailed written response in that area.

Mr. **Buchanan**. As I understood your response, your clarification—go ahead.

Mr. **Rauch**. I just wanted to add, Congressman, that we have reviewed the various materials which the EPA legal staff has prepared and, unfortunately, there is some question on this. We certainly are not going to tell you that in our judgment the Clean Air Act could not be used, but we felt under the circumstances, because of some of the legal uncertainties, it was wise to proceed under the Toxic Substances Control Act.

What is most pertinent here probably is a judgment whether EPA feels it has the authority under TSCA to handle this problem. They have not addressed that yet.

Mr. **Buchanan**. Could you say in your judgment, if you have looked at it, do they have authority under TSCA?

Mr. **Rauch**. We believe they do.

Our principal concern at this point is that they themselves apparently are not convinced to the point where we are and have been somewhat reluctant to move forward. This is one of the reasons we ultimately filed a petition because this would give us the right to proceed against them in court in 90 days if they have failed to reply.

Mr. **Buchanan**. Thank you very much.

Mr. **DeKany**. We have not said to anyone that we do not have the authority. We are currently evaluating the petition.

Mr. **Miller**. Let me ask you something.

In the manuals that you are proposing, that EPA is preparing for the voluntary programs, do they also suggest that schools may want to take a look at their sampling procedures, that after they do the bulk analysis they may also want to look, as Dr. Sawyer pointed out, in the common sense in terms of the state of disrepair that is acceptable; they do not have to wait for other prodding?

Mr. **DeKany**. That is correct, sir, if I understand your question.

Dr. Sawyer is our consultant on that manual. We have a contract for it. Basically we are advocating the general approach Dr. Sawyer spoke of. We also agree with Dr. Sawyer that the air sampling approach is far too tedious, far too expensive, and may be misleading.

So we are depending upon a program or recommending a program of visual examination of the ceiling, then taking a sample to confirm that it is asbestos; so it would be the condition of the ceiling that would be largely the basis upon which you decide to take some action.

I might point out that would likely be the approach in a regulation because it would be very difficult for us to come up with a numerical standard. You can appreciate that, having heard the testimony here. We would probably, given the regulatory option, go on to establish a regulation that would be keyed to the condition of the ceiling and the presence of asbestos.

Mr. **Buchanan**. Counsel just informed me we already have a copy of the article which I asked be inserted in the record. We also have a copy of the letter as well. So you do not have to send it.

Mr. **DeKany**. Thank you.

Mr. **Miller**. In your testimony you have raised it as a matter of contention between yourself and EDP. I have some concern with the voluntary program in terms of what is going to get us the best results. In your testimony you claim you could get us the fastest results.

My concern to some extent, and I assume yours is, the best results. My concern is this: that in Dr. Sawyer's studies on best abatement in the schools, when he talks about motivation, fear is listed twice as to why school boards might take some action. One is the reduction, that they could not use the facility; the second is legal involvement.

I think you ought to keep that in mind, although he does list first the "sincere appropriate concern for the school users." Let's hope that is the motivating force. But I am concerned that there is a lot of foot-dragging and possibly maybe our own statements here will cause some of that to be brought about because some people are going to wait to see who is going to pay for this process, be it the States, the Federal Government, or others.

So I would hope that your voluntary program gets them moving in that direction because at least some of the information we have shows some substantial disrepair in a number of those facilities in various States.

Before you comment, I have a question: I would like to know the theory on which you are going to attempt to hold or you are suggesting EPA should hold distributors, manufacturers, financially liable for the process of repairing these schools where necessary?

Mr. **DeKany**. EDF is going to hold them. EPA is not presently suggesting this.

Mr. **Rauch**. The authority is contained in section 6(a) of the Toxic Substance Control Act, which gives EPA the authority to require the manufacturers and processors of a hazardous substance to either have that substance re-purchased or replaced.

Now, we believe that that can take in both the actual removal of the material that is called for, or the ceiling of those materials as a less restrictive requirement which would be incorporated within the more restrictive requirement of the statute.

We also believe there is sufficient authority in the general principles of tort law to require the manufacturers and processors of fiber to share in this clean-up based essentially on their share of the market during the period in question. It is undoubtedly going to be extremely difficult to trace back each and every sprayed ceiling to a particular sprayer and then to a particular source of that asbestos.

Under those circumstances, again drawing from the principles of tort law, we believe the courts and therefore the agency does have the authority to divide that responsibility in some equitable manner based on a rough approximation of market share and responsibility.

Let me also add that there is no question that there is going to be a major legal battle over who is going to pay for this. But the point is a very simple one. If we wait and attempt a voluntary program for another year or another two years, which will produce very limited results, it is only going to delay that ultimate reckoning.

Our view is, the sooner that recognition is had, the better for all concerned.

We believe the manufacturers and processors must share a substantial part of that responsibility. We expect them to challenge any regulation but we also believe that the law gives EPA the authority to do this and that they will prevail. Our problem now is getting them to try.

Mr. **Miller**. Further questions?

Mr. **Kildee**. No.

Mr. **Buchanan**. Just pursuing that point one moment, some sentiment was expressed here in the committee for the assumption of some Federal responsibility for cost in this connection. Now I do not know how great the cost would be, it depends in part on how widespread the problem is. But it seems to me that Federal assistance would eliminate all the delays and complications involved in litigation and provide an immediate answer, at least for the worst cases.

I wonder if you have any response to that.

Mr. **Rauch**. We have discussed this issue many, many hours within our own organization. In fact, this petition was delayed in its submittal to EPA for several weeks because of debate over that very issue.

We have concluded that Federal assistance certainly would be very helpful if it can be obtained. However, we are reluctant to endorse a principle where the Federal Government will come in and pay for health threats which have been created by private parties, parties who we believe have the knowledge and ultimately the responsibility to protect the users of this material from the hazards of it.

We do not by any means wish to rule out Federal assistance. However, we are quite concerned that if other legal steps designed to get the manufacturers and processors to pay for a portion of this are delayed while we wait for the Federal Government, that the ultimate solution may be delayed.

What we would recommend is that the agency proceed under the existing law. If later it turns out the Federal assistance is possible, we would certainly encourage that. We feel, however, most of that assistance should probably go to the school districts who are going to be the most financially strapped. In other words, ultimately some division of responsibility is probably going to be needed, but any Federal assistance should go to those school districts and should not absolve the manufacturers and processors from their share of the responsibility.

Mr. **Buchanan**. Do you have any comment on that point?

Mr. **DeKany**. Yes. I would like to add that I am not against regulation, being a regulator. I think a regulation pursuant to the requirements of TSCA, and the Administrative Procedures Act, would require, for example, a substantially better survey, for example, than the crude telephone survey that we conducted. I am sure our friends in EDF would not challenge our statements there, but I am sure many of the affected parties might be tempted to.

The only point I want to make is that many of the things that we are asking the States to provide us voluntarily, even if they just survey their schools, would be a valuable input should we later seek to develop a regulation. Even if we could get a modest improvement in the quality of the survey, that would be far better from the standpoint of a regulator in terms of identifying how many schools, or which company, for example, participated in providing that asbestos and so on.

Again, the point I am trying to summarize is, I do not think they are one or the other, I do not think you should look at this thing as either a voluntary or a regulatory program. We in EPA have not made a regulatory decision yet. I am only trying to point out that I think the two go hand-in-hand. In other words, many of the things I am asking my friends in the State and local governments to provide me are things I will have to do in preparing a regulatory package.

Mr. RAUCH. If I may just comment briefly, we have had many discussions on just this point.

Mr. DEKANY. He and I are very good friends.

Mr. RAUCH. The difficulty is, there is nothing in EPA's current plans, and I would love to be corrected, which would result in a survey of all the schools affected; is that not true?

Mr. DEKANY. At the present time we are relying on voluntary compliance. However, you suggested we——

Mr. RAUCH. I am saying absent our petition, there is nothing in your program now that is going to identify these schools, is that right?

Mr. DEKANY. That is correct; we are not ourselves, EPA, physicially going out to inspect schools. We do not have the resources. But in view of the response we got, I am convinced that at least in 30 States we will get some substantial survey results back.

Remember, we have not had an opportunity. The next step would be for Administrator Costle to personally send another letter, the complete package again, to the governors. In addition, we would send them to the various State and local school officials, then to every school district. I am convinced we will get responsible school districts to act in every State in the Union.

Mr. DACH. If we were to agree that some fair number of responsible school districts were going to act, there would still be a substantial number of school districts that would not react. We would like to see a program, in effect, that would require an across-the-board survey so that all school districts would be vested, all school districts would be covered; also the problem Mr. Miller pointed out, that a regulation would result in more prudent and reasonable response and that the determinants of priorities would be set after a recent appraisal of the agency State-by-State, as opposed to the individual school districts.

So there are numerous advantages to going the regulatory approach.

Mr. RAUCH. I just might add, small comfort if you live in one of those States that is reluctant to find out how serious a problem they have, it does not help you that New York City or somewhere else is willing to look at it, your child lives in a State that refuses to do anything. We cannot look at percentages here. We are concerned about all of our children.

As we have seen, even the States that are active, supposedly, in reality have done relatively little.

Mr. HIGHLAND. I was on the phone to a State official in California in response to questions about how extensive the program was. I was asked why I was looking under the bed for more problems, why could I not leave something that was not a problem alone, why was I on a witch hunt?

I would only suggest to you that for a State which is supposed to have an active program or considered to be cooperative, that there are real problems if we rely on a voluntary effort with many officials who will not want to realize the extent of the problem, not want to deal with the remedies which are needed. That is not to say all officials in all States are like that. There are clearly good examples of people who have responded appropriately. But it gives me—and I would assume the American public—little comfort to hear that maybe in 30 States there would be a response. That is what we are optimistically expecting now. That leaves 20 States already in which we may well not have any response at all.

Mr. DEKANY. That would of course be looking at it from one vantage point. From my vantage point, if there is only one school in all of the United States that says EPA, we need your help, we will provide it.

Mr. BUCHANAN. I just come down to the feeling that Federal money does provide some incentive sometimes to get action and it may be a necessary part of whatever else happens. I would hate to see a big delay, while we fight something out in court, if by the immediate application of public funds it could be solved and then worry about the equities.

Mr. RAUCH. If the Congress could appropriate that money within the next year, we would be very happy to endorse that.

As I said, I think it is part of the solution. I do not think anything being suggested today is the exclusive solution. It is going to need help from all sectors.

Mr. MILLER. Thank you very much for your testimony.

The committee will now hear from a panel made up of representatives of the various States, Boards of Education: Mr. Anthony Smith from New York City Board of Education, Mr. Doug Husid from the State of Massachusetts, Dr. Peter Preuss from the State of New Jersey, and Dr. Richard B. Holzman from New Jersey.

[The prepared statement of Mr. Smith follows:]

TESTIMONY BY ANTHONY R. SMITH
EXECUTIVE DIRECTOR OF THE DIVISION OF SCHOOL BUILDINGS,
NEW YORK CITY PUBLIC SCHOOLS
BEFORE THE HOUSE OF REPRESENTATIVES EDUCATION AND LABOR COMMITTEE-
SUBCOMMITTEE ON ELEMENTARY, SECONDARY AND VOCATIONAL EDUCATION,
MONDAY, JANUARY 8, 1979, 9:30 a.m.
RAYBURN HOUSE OFFICE BUILDING - ROOM 2175
WASHINGTON, D.C.

I am Anthony R. Smith. I am the Executive Director of the Division of School Buildings for the New York City Public Schools. On behalf of the Chancellor, Frank J. Macchiarola, I want to express our appreciation to the Chairman, the members of this Subcommittee and other members of this panel for having an opportunity to discuss the problems of asbestos hazards in our School System.

The New York City Public Schools made a preliminary attempt to ascertain the extent of asbestos in our schools in 1976. We now know that the preliminary survey was inadequate, but it was a first step. Starting in early November, 1978, under a new Chancellor, Frank J. Macchiarola, we have been developing an aggressive program for first surveying and then dealing with asbestos in our schools,

As Executive Director of Division of School Buildings, it is my responsibility to carry out the surveying, establish the work priorities and to implement them.

The Subcommittee will have heard from medical and scientific experts considerable details as to what is known and what is not known about asbestos and its actual and potential hazards. The purpose of this testimony is to describe the challenges and public policy issues associated with a major urban educational system when confronted with the need to deal with the presence of asbestos-containing materials in many of its schools.

SCOPE OF THE PROBLEM

As of the fourth week in December, a total of 554 schools have been surveyed by a combination of New York City Department of Environmental Protection's Bureau of Air Resource, the Department of Health and more recently, Division of School Buildings personnel. Asbestos-containing materials are believed to be present in 370 of those schools. Pending the outcome of the bulk sample analysis, which is being conducted for each type of material in each school, the final number is not yet available. Three-hundred and twenty schools have acoustical plaster; 76 schools have spray-on fire proofing material, which appears of the type to contain asbestos; soft acoustical material has been found in 53 schools (this is the spray-on highly "friable" material); asbestos containing materials are located in the pupil-teacher area of 351 of the 370 schools.

WORK PLAN

Our work plan, while lengthy and complex to implement and enormously expensive in our current estimates, is built upon what are generally straightforward answers to straightforward questions:

1. Does the material contain asbestos?
2. Is it friable?
3. Is is accessible?
4. Has the material been damaged or disturbed?

If the answer to each of those questions is yes, then the order of work becomes a higher magnitude of priority. The highest priority for asbestos abatement is set by the extent to which there is apparent damage to the friable asbestos-containing materials. The lowest priority for asbestos-containing material would be, for example, a dense, cementitious, acoustic plaster either located in an accessible spot (say, for example, above 10 ft. in an auditorium), or isolated from the normal environment of the school by some kind of structural material.

Once the level of priority has been set, the next decision is determining an appropriate response to the asbestos containing material at any given location within any given school. We have learned, in the past few weeks, that there is no universal solution, since the use and location and nature of the material varies widely, not only from school to school but even within a particular school. If the material is highly friable and is exposed, even if no damage has occurred, and there is no way to construct a containment barrier, removal may be the only appropriate course of action. In some cases the spraying-on of an encapsulating agent may be appropriate, but that will depend on the extent to which the material is accessible and to whom it is accessible. We have, for example, locations in which there is a friable sprayed-on fire retardant material located in custodial areas. Removal is difficult because of the nature of machinery or other equipment and yet the potential hazard appears too great simply to leave the material, even though it shows little or no sign of disturbance.

In this case, assuming the fire retardant is firmly bonded to the steel beam, the use of an encapsulating agent may be the most appropriate action to use. With an exposed steel beam, however, removal could conceivably be a more appropriate action if no damage were evident. On the other hand, construction of a strong containing barrier might be an even more acceptable alternative.

WORK TO DATE

We have removed asbestos-containing material from five schools. We are in the process of removing from another four. We have used structural containment to isolate asbestos containing acoustical plaster in 5 schools. We are in the process of containing acoustical plaster in 6 schools.

We have taken advantage of what was an unfortunately brief Christmas recess (Dec. 25 thru Jan. 1) to do work in 13 of the above listed schools. Asbestos removal projects are especially time consuming in that they require much set-up time for sealing in the working area. At the completion of the removal, the clean-up phase is extensive and must be carefully done, time being permitted for dust to settle. Some additional work will be done on weekends and short vacations between now and the summer. Our major effort will occur during the summer vacation of 1979. It is our hope that we will be able to remove or in other ways isolate or contain all friable, spray-on asbestos containing material wherever it is either exposed through design or damage. In addition, we plan structurally to contain and isolate acoustical plaster, particularly where there is indication of damage. We will accomplish this isolation by attaching 1/2 inch plaster board to the plaster (with toggle bolts) and bond acoustical tiles to the plaster board. (Cost is about $8.00 per square foot for all associated work.)

One of our most expensive challenges is connected with containing asbestos fire retardant sprayed on steel beams as part of the New York City Fire Code. More than 40 schools, some of them 4,000 and 5,000 pupil high schools, contain asbestos materials used in this manner. Unfortunately, in many of those schools, the suspended ceilings which hang below the steel beams with the sprayed-on fire retardant, are sufficiently low and sufficiently weak, because of the materials used, that they have been damaged or could be damaged in such a way that the asbestos material is not only visible but now becomes accessible. Removal in such cases is virtually impossible because of the magnitude of the job and the length of time that, particularly a large school, would have to be closed. The spraying on of an encapsulating agent is not appropriate either, since, while many of them are quite strong, they are not sufficiently resilient to insure that no penetration would occur if a deliberate attempt were made by a student bent on vandalism, or if some sharp or pointed object were accidentally or deliberately thrown into the material. In this case, we believe the best solution is the construction of a strong suspended ceiling as a barrier between the asbestos and the used school environment. Our intention at this time is to use 1/2 inch plaster board, which will be bolted to the existing metal frame from which the existing suspended ceiling was first hung. Bonded to the plaster board will be acoustical tile, in order to retain an acoustical surface in the corridors and, if necessary, in the classrooms. In most cases we anticipate having to use this approach only in corridors or other highly active areas which are not likely to be closely supervised. Generally, although the suspended ceilings are not ideal, the classrooms are less likely to be vulnerable.

From the overall point of view, the most serious and complex of problems occur when we have asbestos used as a fire retardant throughout on the structural steel of a building and that building is sustaining severe water leak problems. As with many other institutions throughout the country, the Board of Education began using an insulated "slag" roof in the mid to late sixties and into the 1970's. That roof has caused many problems and leaks are extensive in many of our buildings constructed during that period. In addition, water can penetrate a building if the windows fail, if there has been glass breakage, if accidentally or deliberately water overflows in a student laboratory, or if the walls have lost their water proof capabilities. In all of those cases, if water gets into the structure of the building it can, and we have seen it happen in several cases, begin literally to erode the fire retardant material off the steel beams, carry a wet mass of retardant into an active area, such as a classroom, and after drying out, could become airborne, either when the building is used by students and/or in the course of a normal dry broom or dry mop cleaning.

Thus, dealing with asbestos is not simply a problem of removing, isolating, or containing the asbestos materials themselves. It will involve, in many of our schools, major structural renovations, repairs, or other maintenance activities. With over 1,000 buildings in our system, the coordination of two sets of renovation and maintenance priorities is complex.

COST OF THE WORK

We estimate that we have an average of 10,000 square feet of acoustical plaster in each of 320 schools.

We have estimated an overall cost of our asbestos abatement program at somewhere between $35 million and $48 million. The reason for the large spread in the estimate goes back to the point made earlier, that different work approaches will be necessary from school to school and within different sections of any given school. We estimate the cost of structurally containing the acoustical plaster with bonded on acoustical tiles at somewhere in the neighborhood of $25 million. We believe there may be roughly $500,000 worth of removal that will have to occur in connection with sprayed-on friable, accessible, soft acoustic material and possibly some removal of spray-on, friable, fire retardant material.

The $10 million to $18 million remainder of our estimate covers the cost of containing sprayed-on fire retardant behind solid, barrier suspended ceilings, and, in some case, encapsulation.

It is not necessary for the representative of any large urban school system to dwell on the staggering financial implications of the above estimated expenses. At a time when virtually all older cities are confronting increasingly austere budgets, at a time when the federal budget in the area of health, educational and environmental protection appears to be facing drastic cutbacks, at a time when our own particular jurisdiction, New York City, is facing several more years of enormous fiscal difficulties, the sudden appearance of a problem that might cost nearly $50 million to correct, which had been totally unforeseen until 60 days ago, is to put it mildly, overwhelming.

PUBLIC POLICY ISSUES

To this point this testimony has dealt almost entirely with data, some hard, some projected but basically cold numbers and engineering approaches for dealing with a series of large problems. The testimony is, then, to this point incomplete. As important as forthrightly accepting the nature and scope of the engineering challenges, is the responsibility of public officials to deal forthrightly with a concerned and often frightened public. Because medical science has not yet established a safety/danger threshold below or above which a hazardous condition may or may not exist, and because air sampling and electron-microspy is not a standardized procedure, the public must join with the experts in accepting that we must take prudent courses of action, and at the same time not over-react.

Dr. Irving Selikoff, Director of the Environemntal Sciences Laboratory of Mt. Sinai Hospital in New York City, a nationally recognized expert on the effect of asbestos in the environment, put it well when he suggested that appropriate action to isolate, contain, or remove material from the environment of a school must be taken, but that it is not appropriate to use "both belts and suspenders". In that succinct phrase,Dr. Selikoff summarizes that we are attempting to do in New York City: the right thing in all cases, but not to expend more funds than are appropriate or necessary to deal with a given problem, in a given location, in a given school.

In dealing with the public, there is obviously a center position which responsible government officials must stake out between appearing to be, or worst, actually being, complacent about the problem,or fanning the flames of fright, which could lead, quite literally, to the emptying of many schools, or other facilities. So far, we believe we have stayed in that proper and appropriate middle ground. We have had flashes of great fear associated with problems in certain individual schools. We have been candid in admitting when we did not know the answer to something, and we have been candid in admitting mistakes, where they have been made. It must be remembered that all of us in the City school community are still in the process of learning about asbestos and the method for handling it, which is why I am here today. It is, I suspect, inevitable that some mistakes will be made either in the engineering or in the attempts to convey information to the public. Acknowledging this in advance will make it no easier to deal with. Nevertheless, we think that the overall posture and attitude of the Board of Education and its administration are, in fact, increasingly perceived and understood to be, constructive and responsible.

FEDERAL ASSISTANCE

We are looking now to Washington for help. Both the health and the education components of the Department of Health, Education and Welfare, it would seem self-evident, have a stake in providing assistance to jurisdictions attempting to deal forthrightly with the problem of asbestos in their school systems. We also believe that the Environmental Protection Agency has a major role to play both in providing technical assistance of all types, up to and including construction, engineering or other personnel under the Intergovernmental Personnel Act, but also in pursuing whatever recourse there may be through existing federal legislation to either negotiate or compel assistance from the manufacturers of asbestos materials to ease both the financial and the public policy burdens with which we are now confronted.

We must have help from Washington in a number areas:

a) Training and education. There are several approaches to eliminating the various forms of asbestos found in our schools. We recommend that the different approaches to be used in a number of our buildings become federally funded demonstration projects. Other school systems, which will be going down this road in the near future, will be able to gain from our experience.

b) Technical Assistance

1. A great deal of laboratory work is necessary to verify the presence of asbestos. Present estimates indicate that approximately 1,000 bulk samples will require analysis. The costs can be as high as $35 per sample; coupled with the need to do extensive "blind" testing as cross checks, the expense is significant.

2. What labs can we safely use? We need some type of rating, grading or evaluating system.

c) Management Controls. We must construct a series of "fail-safe" screens,to ensure that future work done in one of our schools is done with the knowledge of: 1) whether asbestos is present; 2) where it is and 3) how it has been used. With such a system in place, future work can be carried out safely.

d) There are rigorous requirements related to the safety of workers during the performance of contracts related to asbestos. Strict measuresmust be taken to protect the environment and those in it during the construction work. Only with the most stringent supervision of the contractors during the performance of the work, can we be assured complete compliance with regulations. Funding for construction supervision for a period of 12 to 18 months would be needed for optimum enforcement.

We believe that federal assistance should be made available now.

In connection with the specific programmatic needs described above, I participated in a meeting with two branches of the National Institutes of Health on January 3, 1979:

1. The National Institute of Environmental Health Sciences (NIEHS), represented by its Director, Dr. David Rall and,
2. The National Cancer Institute (NCI) represented by its Director of Cancer Control, Dr. Diane Fink and NCI's Preventive Medicine Component, represented by Dr. Richard Koslow.

From this first preliminary meeting, I have received an expression of great interest on the part of NCI and NIEHS to see whether it may be possible to develop a pilot program of demonstration projects. A number of federal agencies could be involved and through the good offices of Drs. Fink and Rall, I hope in the near future to be meeting with some of those agencies. They would include, in addition to NCI and NIEHS the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Administration (OSHA), the Environmental Protection Agency (EPA). Other agencies which conceivably might be involved to provide some sort of technical-personnel assistance through the Intergovernmental Personnel Act might include: the Army Corps of Engineers; NASA, and any other federal agency with engineering responsibilities which could assist us in overseeing the rigorous technical requirements necessary when work is being done in or around asbestos-containing materials.

The asbestos problem will not go away, it cannot be ignored, and it is not isolated to a few jurisdictions such as New York, which are approaching the problems frontally. We will need a massive program to educate, to survey, and ultimately to eliminate this problem from our schools and from the learning and developmental environment of our children.

APPENDIX

Following are two specifications to be used as guides for our technical personnel. They are intended to be used in the preparation of contracts to be bid.

The specifications are for use in isolating asbestos-containing materials as follows:

1. Structural Containment of Sprayed-on Asbestos Materials.
2. New Acoustic Covering over Existing Acoustic Plaster.

Plans shown in the specifications are subject to approval of the N.Y.C. Department of Buildings.

The specifications attached show all required structural work. Necessary adjustments to electrical fixtures, and ducts (to accomodate the new ceiling elevation) have been included in the Acoustic Covering specification but have not been shown in the Structural Containment specification. Although this latter installation may require such changes, each field condition must be treated on an individual basis.

The estimated cost for doing all the work required (including electric and ductwork changes) for either of the specifications is $8.00 per sq. ft.

In the N.Y.C. Board of Education system the estimated costs to isolate sprayed on asbestos and acoustic plaster would then be as follows:

1. Structural Containment:	76 schools	-	$ 11,800,000
2. New Acoustic Covering:	320 schools	-	24,600,000
	Total		$ 36,400,000

Encapsulation of sprayed-on fireproofing with an approved sealant has not been included in the specifications nor has it been included in the estimate. Where encapsulation is deemed necessary, the estimated cost is $2.75 per square foot of sprayed-on fireproofing.

SPECIFICATION
FOR
STRUCTURAL CONTAINMENT OF SPRAYED-ON ASBESTOS MATERIALS

GENERAL DESCRIPTION:

These sections describe a method of structural containment that will enclose the asbestos materials within a hung ceiling space. The construction assembly is composed of gypsum drywall panels secured to an existing ceiling suspension system. Joints are sealed and acoustical tile is bonded to the gypsum drywall to restore acoustical values.

In the attached specification, the existing suspension system had been installed to support an acoustical tile ceiling. The suspension system is re-used with the addition of new runners that will permit the drywall material to be screwed in place.

This overall method will not apply to every application. Each situation must be judged on several considerations including accessibility and susceptibility to damage, control and supervision of occupied areas. Details of the existing suspension system will vary. The method of fastening the new ceiling must be adapted to the existing system.

SPECIFICATIONS

SCOPE:

Remove existing acoustical tile, and Z spline furring channel from ceiling system. Install new furring channels. Existing hangers and running channels to remain. Install new Gypsum board ceiling and new acoustic tile.

SECTION 1

GYPSUM DRYWALL

PART 1 - GENERAL

1.01 MANUFACTURE

A. United States Gypsum Co.

B. or approved equal.

1.02 DELIVERY AND STORAGE OF MATERIAL

A. All materials shall be delivered in their original unopened packages and stored in an enclosed shelter providing protection from damage and exposure to the elements.

B. Damaged ordeteriorated materials shall be removed from the premises.

1.03 ENVIRONMENTAL CONDITIONS

A. In cold weather and during gypsum panel application and joint finishing, temperatures within the building shall be maintained within the range of 55° to 70°F.

1.04 SAMPLES

Submit samples of furring channels for approval.

PART 2 - PRODUCT

2.01 MATERIALS

A. Gypsum Panel ½" gypsum panels (single layer, or as otherwise indicated.

B. Fasteners - Self-tapping steel screws with rust inhibited coating.

C. Metal Accessories - trim, etc. shall be galvanized steel.

D. Joint Treatment-as recommended by manufacturer.

E. Perimeter Caulking-Acoustical as recommended by manufacturer.

F. Control Joints-Zinc.

G. Metal Furring Channels-20 ga. galvanized.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Gypsum ceiling panels screw attached to new metal furring channels.

B. Provide control joints where ceiling abuts dissimilar wall or ceiling or a structural element.

C. All joints shall be taped with 3 coats of joint compound, finished smooth. New ceilings shall be completely air tight.

D. Contractor shall cut holes for all openings for electrical fixtures, outlet boxes and HVAC openings.

END OF SECTION

SECTION 2

ACOUSTIC CEILINGS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Gypsum Board
B. Electric Fixtures, N.I.C.

1.02 SUBMITTALS

A. Shop Drawings

1. Complete layout of installation showing size and pattern of tiles, and complete details of suspension system for approval.

2. Indicate recessed lighting fixtures and access doors.

B. Samples

1. Mineral Fiber Tile - Three of each type.

2. Metal Face Tile - Three of each type.

3. Approved prior to erection.

1.03 EXTRA STOCK

Deliver to Custodian one (1) box of each type containing approximately sixty (60) square feet properly labeled.

1.04 REGULATORY AGENCIES

A. New York City Board of Standards and Appeals (BSA) Approval.

B. New York City Materials Evaluation Approvals (MEA) Approval.

C. New York City Building Code

D. Acoustical and Insulating Materials Association.

1.05 GUARANTEE

Work showing any of the following defects within the one year guarantee period specified in the Contract shall be corrected as directed by the Executive Director.

A. Loose Tile or Tiles improperly secured.

B. Tiles showing discoloration or cracking.

PART II - PRODUCT

2.01 MATERIALS

A. Mineral Fibre Tile (Incombustible), Plain Metal Face Tile

1. Materials shall conform to "Architectural Acoustic Materials" latest edition.

2. See drawings for location and extent.

3. Type to be selected by Executive Director.

B. Adhesive

Factory made product recommended by manufacturer of the tiles used.

PART III - EXECUTION

3.01 JOB CONDITIONS

Acoustical material shall be installed under conditions as outlined in the current bulletin of the Acoustical and Insulation Materials Association "Job Conditions".

3.02 PREPARATION OF WORK

Examine the building before beginning work to determine that the structure is in proper condition to receive acoustical materials and suspension system. Area shall be broom cleaned and uninterrupted for free movement of rolling scaffold. Do not proceed until satisfactory conditions prevail.

A. Kitchen

Remove existing metal pan ceiling.

B. Install new hung ceiling, gypsum board and plain metal face tile, Acoustic Clad, as manufactured by Johns Manville or approved equal.

C. Ceiling system to be completely air tight. Caulk around all electric and H.V.A.C. Fixtures.

D. All work to be done with a minimum disturbance to existing materials.

3.03 INSTALLATION

A. General

1. Install in patterns indicated, (balanced borders all sides) symmetrical or centered about center line of corridors, panels, fixtures, and spaces.

2. Cut as required for installation of electric fixtures, access doors. (Verify sizes and locations with Electrical, Heating, and Ventilating.)

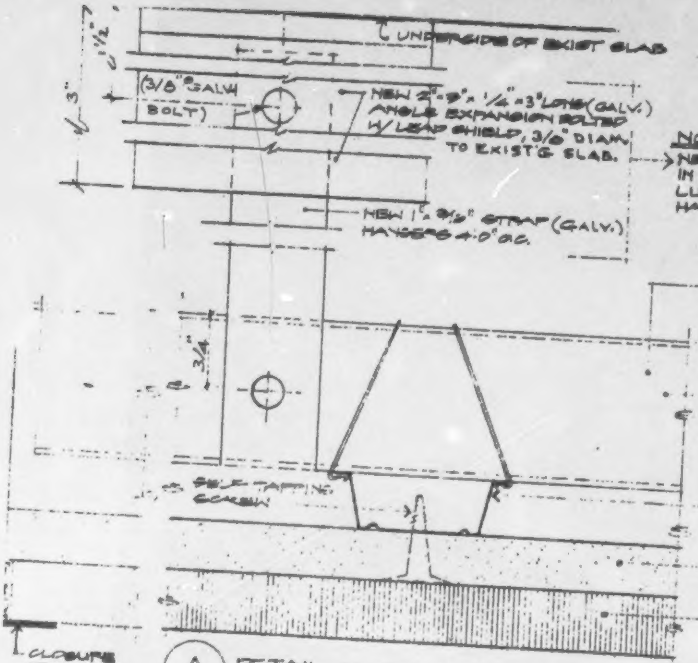
3. On completion, the acoustic ceilings shall present a uniform plane surface, free from blemishes and imperfections.

B. Cementing of Tiles

1. Cement tiles directly to gypsum board ceiling with 4 spots of adhesive to each square foot of tile.

2. Each spot of adhesive shall produce a surface of not less than 2" in diameter after tile has been pressed in place.

END OF SECTION


℄ UNDERSIDE OF EXIST SLAB
1½"
3"
(3/8" ⌀ GALV. BOLT)
NEW 2"×3"×¼"×3" LONG (GALV.) ANGLE EXPANSION BOLTED W/ LEAD SHIELD, 3/8" DIAM. TO EXIST'G SLAB.
NEW 1"×3/16" STRAP (GALV.) HANGERS 4'-0" O.C.
¾"
SELF-TAPPING SCREW
CLOSURE TRIM TO SUIT
EXIST. 1½" [. 4'-0" O.C. TO REMAIN.
IN EXIST. KITCHEN & LUMINOUS CLG. AREAS ONLY PROVIDE NEW 1½" [s (GALV.) 4'-0" O.C. & SECURE TO NEW STRAP HANGERS AS SHOWN WITH 3/8" DIAM. GALV. BOLT.
NEW 7/8" GALV. FURRING CHANN. 12" O.C. CLIPPED TO EXIST CHANNEL
NEW ½" GYPSUM BOARD. NOT TAPE & SPACKLE ALL JOINTS.
NEW PASTE ON ACOUSTICAL TILE (SEE SPECS).

NOTE

NEW ANGLE & STRAP HANGERS IN EXIST. KITCHEN AREA & LUMINOUS CEILING AREA ONLY. HANGERS ARE EXIST. ELSEWHERE.

A DETAIL OF NEW ACOUSTICAL TILE HUNG CEILING SCALE: FULL SIZE

____

____

BOROUGH OF ______________________

SCHEDULE SPECIFICATION FOR

NEW ACOUSTIC COVERING OVER
EXISTING ACOUSTIC PLASTER

LUMP SUM BID SHALL BE SUBMITTED FOR ALL THE WORK OF THIS SPECIFICATION

PART 1 - GENERAL PROVISIONS

.1 STANDARD SPECIFICATIONS: The Standard Specifications for General Construction Work, Tentative May 1960, as amended by Addenda No. 1, Tentative June 30, 1967, each under separate cover referred to hereinafteras the "Standard" specify material and workmanship requirements for this contract. Section 1 of the Standard shall, in its entirety, apply to this contract. Only such other portions of the Standard as specified in Part 3 of the Schedule Specifications shall be applicable to this contract.

Copies of the Standard Specifications for General Construction Work, Tentative May 1960, and Addenda No. 1, Tentative June 30, 1967, are available in the bid room.

2. WORK INCLUDED

.1 Gypsum panel installation over existing acoustic plaster:

A. CEILINGS: Install new 1/2" thick gypsum panels at the following locations:

B. WALLS: Install new 1/2" thick gypsum panels at the following locations.

C. New gypsum panels shall be equal to sheetrock gypsum panels as manufactured by United States Gypsum. The width shall be 4'-0" with T&G edges. They shall comply with Federal Specification SS-L-30D; ASTM C36.

D. Panels shall be secured as follows:

1) To acoustic plaster on suspended ceiling system with 1/4" toggle bolts. Spacing shall be 24" o.c. perpendicular and 16" o.c. parallel with major axis of panel and no more than 8" from the edges of gypsum panel.

2) To acoustic plaster on metal stud partition with 1¼" type G Bugle Head screws as manufactured by U.S.G. or equal. Spacing shall be 9" o.c. with no more than 3" from the edges.

3) To acoustic plaster on concrete ceiling slabs or on wall masonry with ramset fasteners. Spacing as specified for toggle bolts.

NOTE: Use oversized washers with toggle bolts and ramset fasteners.

E. Cut panels as required around electric fixtures, air diffusers, grilles, access doors and any other built-in item.

F. Tape and spackle all joints between panels and all joints at abutting surfaces. Seal exposed edges with expoxy compound and install an approved molding.

G. Spray cut-outs with acrylic paint when removing and re-installing built-in items.

2.2 ACOUSTIC TILE INSTALLATION ON CEILING:

A. Install new acoustic tiles over the entire installed gypsum panel ceiling as specified herein before.

B. New acoustic tiles shall be 12"x12"x3/4" square edge mineral fiber tiles. Tiles shall be non-combustible, have a class "A" rating and shall contain NO ASBESTOS FIBERS.

C. Tiles shall be installed using splines on all sides.

D. Tiles shall be cemented to ceiling with "Fire Resistant Acousti-Gum Latex Acoustical Tile Adhesive #237" by W. Henry or approved equal.

E. Tiles shall be centered about center lines of corridors, panels, fixtures, rooms or spaces in which they are installed.

F. Cut tiles as required around electric fixtures, air diffusers, grilles, access doors and any other built-in items.

G. On completion, the acoustic tile ceiling shall present a uniform plane surface, free of blemishes and imperfections.

H. Edges at walls shall be finished with 1"x1" angle molding or other approved molding.

2.3 Acoustic tile installation on walls (the areas above 10'x0" height)

A. Install new acoustic tiles over the installed gypsum panel walls specified herein before.

D. Tiles [illegible]
Acoustical Tile [illegible] Manry or approved equal.

E. Cut tiles as required around electrical fixtures, air diffusers, grilles, access doors and any other built-in items.

F. Edges shall be finished with proper edging strips.

2.4 Corkboard installation of walls (the areas below 10'-0" height).

A. Install new 1/4" thick vinyl impregnated corkboard over the installed gypsum panels specified hereinbefore.

B. Finish all exposed edges with aluminum "J" trim.

C. Adhesive for installing corkboard and "J" strip shall be as recommended by manufacturer of corkboard.

2.5 SEALING OF WORK AREA:

A. Before any work is done, the area must be sealed with a six (6) mil polyethylene dust barrier. Also all ducts in work area are to be sealed with six (6) mil polyethylene sheets and duct tape. Immediately inside work area, all workers shall put-on and take-off their disposable coveralls. No worker shall be permitted to leave the work area in his disposable coveralls for any reason.

B. All doors leading off work areas shall be closed and locked except as required for access.

2.6 WORK UNIFORMS:

A. Each worker shall be supplied with disposable coveralls. Coveralls when removed shall immediately be deposited in a (6) six mil polyethylene bag. Bag of used coveralls shall be placed in a second (6) six mil polyethylene bag tied securely and disposed of.

B. In addition to coveralls supplied to workers, the contractor shall have on hand at the start of each work day (4) four additional coveralls for use by Board of Education Personnel authorized to inspect the work site.

2.7 RESPIRATOR MASKS:

A. Each worker shall be supplied with an approved type respirator mask and shall change the filter in the mask twice a day.

B. In addition to respirator masks for workers, the contractor shall have on hand at the beginning of each day (4) four masks for use by Board of Education Personnel.

2.8 CAUTION SIGNS:

A. Contractor shall install signs at all [illegible] to work area as follows:

1)

Legend	Notation
Asbestos	1" Block
Dust Hazard	3/4" Block
Avoid breathing dust	1/4" Gothic
Wear assigned protective equipment	1/4" Gothic
Do not remain in area unless your work requires it	1/4" Gothic
Breathing asbestos dust may be hazardous to your health	14 point Gothic

2)

Legend	Notation
No food, beverages or tobacco permitted	3/4" Block

3)

Legend	Notation
All persons entering work area shall wash their hands and face immediately after leaving work area	3/4" Block

2.9 The contractor is responsible to insure compliance with all regulations noted on cautions signs in Para. 2.7.

2.10 CLEAN UP OPERATIONS:

A. Contractor shall wet mop work area at completion of work in each area. All mop heads used shall be placed in securely tied double (6) six mil polyethlene bags and disposed of.

2.11 DISPOSAL:

A. All materials used for sealing area, coveralls, mask filters, dislodged materials, mop heads, acoustic tile scraps and any other materials to be disposed of from work area shall be double bagged and tied securely before disposal.

2.12 ELECTRIC WORK:

A. Lower all electrical fixtures located in existing acoustic plaster ceiling and resecure in new tile ceiling to finish flush with new ceiling.

B. Disconnect all electrical fixtures and outlets set in acoustic plaster walls and extend out to new location flush with new walls.

C. All work shall be done in accordance with New York City Building Code by a licensed electrician.

2.13 HEATING AND VENTILATING WORK:

A. At all locations where duct work ends at an air diffuser or flush grille in acoustic plaster, remove grilles or air diffusers and re-install grilles and/or air diffusers flush with new surface.

3.0 MATERIALS AND WORKMANSHIP:

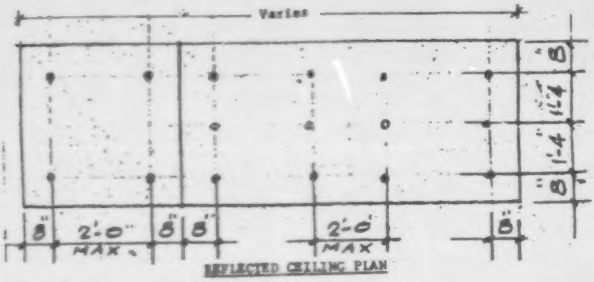
3.1 General conditions as per Standard Section 1 all applicable paragraphs.

3.2 Furring lath and plaster as per Standard Section 8, paragraphs 1, 2,3,4, 8,9,10,21,22,24,26,27,28,29.

END OF SPECIFICATION

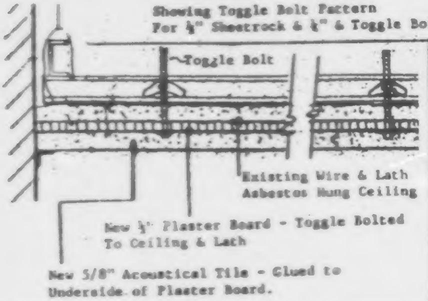
OF:rr:mr
1/2/79

SALVATORE SCIAMO, Director (Acting)
Office of Building Services


Varies
8"
2'-0"
MAX.
8"
8"
2'-0"
MAX
8"
8
1'-4
1'-4
8

REFLECTED CEILING PLAN

Showing Toggle Bolt Pattern
For ½" Sheetrock & ¼" & Toggle Bolts


Toggle Bolt
Existing Wire & Lath
Asbestos Hung Ceiling
New ½" Plaster Board - Toggle Bolted
To Ceiling & Lath
New 5/8" Acoustical Tile - Glued to
Underside of Plaster Board.

TOTAL WEIGHT OF CEILING

Existing:
1" Gypsum = 4.0 # /SF
Lath @ 3.4 #/YD = 0.4 # /SF

Sub Total = 4.4 # /SF

New:
½" Gypsum BD. = 2.0 # /SF
5/8" Acous.T. Tile = 1.0 # SF

Total 7.4 # /SF

CALCULATION FOR TOGGLE BOLTS ON METAL LATH

13 GA. = .090
21 GA. = .033

3.4# Lath (Diamond Pattern)

2 X 13 GA. = 180
13 GA. Wide X 21 GA. Thick

rea of Shear = .18 X .033 = .00504 in 2 - Shear allow = 14.5 KSI
er. each Rib P allow = 14.500 X .00594 = 86.13#

. Min. of 2 Ribs in Contact P allow per Toggle Bolt = 172#

ach Tied to Furring Bars @ 6" O.C. with 18 GA. Wire - Dia. =.0475 A=.7854 X.0475 ^{2}
A= .001772 in ^{2}

ay 18 KSI Allow in Tension - P Allow = 18,000 X .001722 = 31.9 # --- 32#
For A 5' X 4" Furring Pattern
inimum # of Ties = 3C each 36 X 32/20 = 57.C # SF Allow.

TYPICAL METHOD OF ENCLOSING ASBESTOS
CONTAINING ACOUSTIC PLASTER FIRE RATED CEILING

STATEMENTS OF ANTHONY SMITH, EXECUTIVE DIRECTOR, DIVISION OF SCHOOL BUILDINGS, NEW YORK CITY BOARD OF EDUCATION; DOUG HUSID, EXECUTIVE DIRECTOR, SPECIAL LEGISLATIVE COMMISSION ON ASBESTOS, STATE OF MASSACHUSETTS; DR. PETER PREUSS, DIRECTOR OF TOXIC SUBSTANCES PROGRAM, DEPARTMENT OF ENVIRONMENTAL PROTECTION, STATE OF NEW JERSEY; DR. RICHARD B. HOLZMAN, SUPERINTENDENT OF SCHOOLS, CINNAMINSON TOWNSHIP PUBLIC SCHOOLS, CINNAMINSON, NEW JERSEY, AND MR. TYLER

STATEMENT OF ANTHONY SMITH, EXECUTIVE DIRECTOR, DIVISION OF SCHOOL BUILDINGS, NEW YORK CITY BOARD OF EDUCATION

Mr. SMITH. Thank you, Mr. Chairman.

I am Anthony R. Smith, Executive Director of the Division of School Buildings of New York City.

The magnitude of all problems in New York City is probably now somewhat boring and repetitive to the members of Congress. But I would like to give you some sense of how large our system is and therefore the magnitude of the problems that we confront.

We have over 1,000 school buildings in the New York City system. That is over 100 million square feet, which perhaps for you as for me is easier to think of in terms of 28 Pentagons or 30 World Trade Center tours. The problems are indeed enormous.

We have nearly one million students. We have to date surveyed 554 schools and have found the probability of asbestos-containing materials in 370 of those 554 schools.

When I say probability, it is because, as has been noted repeatedly this morning, pending the results of samples taken in bulk, conducted by the less than a handful of laboratories in the country that are able to do it, we will only then be certain. But we are, unfortunately, having very few negatives turn up. Generally we are pretty good in knowing where it is now.

I would like to deal with two issues if I might that I think have not been touched on in much detail and they are mentioned in my testimony.

Congressman Kildee repeatedly asked a question which has been put to me over and over again as I have attempted to deal with concerned parents, teachers, students, custodial personnel and others in New York City.

If your child were going to this school, would you let him go into that classroom or that room? That question summarizes what I think is at the core of the non-technical aspect of this problem and I think it is one that must be addressed on the same level with a percent of chrysotile or the way in which the material was used. It simply boils down to the two most prevalent emotions that we all face, and that is love and fear.

Love and fear is what is at the core of the response. For those of us finally at this table who are in the trenches trying to deal with this, those are the issues we have to deal with. We have fortunately the availability of men like Dr. Sawyer who have given unstintingly of their time, their experience, and their knowledge. But ultimately it is we public officials who are in those trenches who have to deal with people who are frightened and they are frightened because what they love most may be threatened. There are no easy answers for dealing with those problems of love and fear, but they cannot be ignored by any public official confronted with this kind of problem.

The borderline between being complacent or appearing to be complacent and being hysterical is very fine, and it requires a close cooperation and an enormous sense of trust between the public officials involved, the parents involved, and ultimately, frankly, the media and how they report it. I am not talking about managing news, I am talking about reporting the facts as they are and not overstating and not putting out headlines such as "Death Dust Found in Schools."

The other major area that I would like to deal with in my statement, which I think has not been touched upon at all this morning and which I think is ultimately among the most critical: We are in New York City definitively going to leave asbestos-containing materials in many, many of those 370 schools. There are a great many reasons for that. They include the radical application of common sense, as Dr. Sawyer described it. There are some cases where it is simply not a rational response to a problem to go into the high risk and high expense operation of removal.

In most of those cases, however, where we are leaving it behind, we are going to leave it behind either encapsulated, contained behind a strong barrier ceiling, or contained behind a drywall system which is bonded either with toggle bolts or with a bonding agent, a glue, to a dense cementitious material. I mention this because I think frankly too much attention has been paid this morning to sprayed-on asbestos and to what sounds like a relatively simple question, whether or not it is friable, can be broken with one hand.

The fact is that asbestos in acoustical plaster while it is harder than the fluffy stuff can be damaged with the fingernails, the ruler, the book edge of an interested or uninterested child, and we have to protect that child from that interest or noninterest. And that means constructing a barrier that will isolate the material from the used environment of the school.

But we are going to leave it behind. And that means we have a major responsibility, and that is to develop a management system in place to insure that the institutional memory, long after someone like me, who remembers the problem, leaves office, there has got to be a series of screens through which anyone who is going in to do work in any given school will have to pass, so that he will know there is asbestos material in that school, he will know where it is, he will know where he can get through it because a barrier of penetration was built in or, most likely, where specific regulations and guidelines are going to have to be imposed because he has to go through that material with some kind of power equipment and risk contaminating not just himself but the building.

That is not an easy system. It is one of the areas that has been, if I may speak candidly, not addressed by anyone who has spoken so far today. It is one which we have to deal with and it is one to which frankly we turn to the Federal Government for assistance.

We have had the opportunity of speaking with representatives of several Federal agencies last week on this and other subjects. It is one we will need help. I think we have a large and well-prepared laboratory experience in New York to help devise these systems, but they will have to be in place. Otherwise, frankly, we are not meeting our responsibilities to this and future generations in our school system.

Finally, I would like to leave one thought which is again something that I think we have focused very heavily on, vandalism, youthful exuberance, maintenance and repair as one of the problems that causes asbestos fibers to become airborne.

There is another area which has really not been looked at. We feel it particularly painfully I think in New York City where we have had to defer maintenance now for several years. A leaking roof fixed today can be fixed quickly, and if it is only the second day of the leak, relatively inexpensively. If you start deferring maintenance the costs go up exponentially, and water is one of the more frightening things to deal with when it becomes married to asbestos, particularly asbestos sprayed onto steel beams as a fire retardant which is not necessarily visible. The water literally erodes the fire retardant off those beams and brings it down into the used environment of the school, where after it is dried out, it can become reentrained, suspended in the atmosphere.

It is a problem primarily because in many of our institutions—I am sure not just school boards—what looked like a marvelous new roof was introduced into the institutional architectural world in the mid-'60s right at the height of the use of asbestos as a fire retardant material, and that roof which was inexpensive and easy to install leaks badly. And many, many of our buildings have that problem.

We also have failing windows, we have labs with sinks that overflow and water that can penetrate or enter the building from a variety of sources. We are not simply talking about the cost then of abating the asbestos problem, we are talking about really making the entire structure safe so that asbestos can be left behind, if indeed that is the dictated approach.

The problems are enormous and very expensive and we will need technical assistance from every source that we can get it, and I must say so far I think that we have been very fortunate to have Mount Sinai in New York City and helping us. We have been fortunate indeed to have Yale University make Dr. Robert Sawyer available to us. We have benefited from counsel of the EPA, from the National Institute of Environmental Health Sciences and National Cancer Institute. It is only a beginning but we have started.

Thank you, sir.

Mr. MILLER. Mr. Husid.

STATEMENT OF DOUG HUSID, EXECUTIVE DIRECTOR, SPECIAL LEGISLATIVE COMMISSION ON ASBESTOS, STATE OF MASSACHUSETTS

Mr. HUSID. Thank you very much, Congressman Miller. It is a pleasure to be here this afternoon.

The presence of asbestos bodies in the lungs of those occupationally exposed to it has been acknowledged for over 40 years. Its direct link to fatal diseases including asbestoses, lung cancer and mesothelioma is now clear and well-documented. While a great deal of research and attention has been devoted to analyzing and attempting to control asbestos exposure in an occupational setting, it has only been in recent years that the scientific community and government have begun to turn their attention to the dangerous and much more far-reaching implications of public exposure.

Many of the standards and techniques necessary to quantify the magnitude of the health impact of public exposure to moderate and low levels of asbestos are still evolving. This body will no doubt hear a great deal about those issues in the course of its hearings. What has become evident in the last six years is that the problem is sufficiently serious and widespread to require a commitment of governmental resources to attempt to come to grips with it. Massachusetts has, in fact, begun to accept this responsibility.

I have served for the past year and a half as executive director of the Massachusetts Special Legislative Commission on Asbestos. The commission, the only one of its kind of which I am aware in the nation, has as its mandate to "evaluate the public health hazards of asbestos in schools and public buildings, and the need for its containment and removal." In the belief that it would prove instructive and valuable to the committee and other States who may consider similar programs, I would like to trace briefly for the committee the history of the commission's formation and operation.

In September of 1973, the city of Newton, Massachusetts, opened a new $18 million high school. Within a year of its opening, an asbestos problem was discovered by one of the school's science teachers. Aroused faculty and community interest led to an evaluation by experts including Dr. Nicholson of Mount Sinai Hospital, and the eventual expenditure of almost $300,000 to control the problem. A State representative from Newton, Representative Lois G. Pines, whose husband is a physician and lung specialist, played a major role in persuading the local government of the need to undertake corrective action. Alarmed by the presence of such a problem in a new school, Representative Pines became increasingly concerned with the likelihood of similar and possibly more severe problems in older schools throughout the State.

Culminating an effort begun in 1974, in June 1976, Representative Pines succeeded in having the Special Legislative Commission on Asbestos authorized and appointed. The makeup of the commission as defined by the statute creating it, was designed to provide a broad base of expertise from the variety of disciplines necessary to deal comprehensively and effectively with the problems of detection, analysis and containment. Included are: five members of the legislature, the Commissioner of Public Health, the Director of the Division of Occupational Hygiene, physicians specializing in pulmonary diseases and in cancer, an expert in environmental health sciences, and a chemist, architect and structural engineer. In addition, a number of advisers have been added including representatives of the asbestos workers union, State Department of Education, and public interest groups.

The commission was, however, unfunded during its first year of existence. Guided by the commission's expertise and with the assistance of student interns, Representative Pines, who serves as the commission's cochairman, continued her efforts, begun in 1974, to obtain outside funding for a survey of asbestos hazards in public schools and buildings. Despite an intensive effort, which is chronicled in the commission's 1976 report to the legislature (Appendix A) these attempts were unsuccessful. A literature search was conducted and an annotated bibliography was prepared for use in grant applications. Approaches to both private agencies including the National Science Foundation, Rachel Carson Trust, and the American Association for Cancer Research, and public agencies including EPA, OSHA, NIOSH, and NIH produced great encouragement but no money.

Concurrent with its quest to obtain funding, the commission spent a substantial amount of time developing guidelines for a survey of asbestos hazards in public schools. Although these guidelines were continually altered and modified once the survey actually began, this period of discussion and planning proved invaluable. Many of the potential difficulties and roadblocks were flagged and avoided. In addition, a subcommittee was created for the purpose of developing standards by which to evaluate data to be collected in the survey. The decision to initially focus on schools was a function of both an overriding concern for the future and health and safety of the children of the State, and a recognition of the limitation on resources the commission was likely to have at its disposal.

Disappointed but undaunted by her inability to obtain outside funding, Representative Pines decided in 1977 to concentrate her efforts on obtaining a legislative appropriation. Despite greatly increased media attention on its effects of asbestos on shipworkers and their families, the issue was still of minimal concern to many in government faced with growing demands and dwindling financial resources. Armed with a 1-year budget proposal of $100,000 (Appendix B) prepared by the commission and the Division of Occupational Hygiene (DOH), Representative Pines, nevertheless, pressed the issue vigorously both with the legislative and executive branches of Massachusetts State government. She found an invaluable ally in the Speaker of the House, Thomas McGee. With his support and strong backing in the Senate from Senator Robert McCarthy, cochairman of the commission, Representative Pines succeeded in obtaining a $50,000 appropriation for fiscal 1978. A subsequent $50,000 appropriation was also obtained for fiscal 1979.

It is doubtful that any meaningful investigation could have been conducted on such a budget. The accomplishments of the commission to date is a function of, and a tribute to interagency cooperation and coordination, and the willingness of several State officials to commit substantial amounts of their own resources to achieve a purpose for which they were technically not responsible.

In particular, Commissioner Nicholas Roussos of the State Department of Labor and Industries and two of his division chiefs, Harold Barley of DOH, and Andrew Currie of Industrial Safety (DIS), provided invaluable and irreplaceable expertise, resources, and personnel to the Commission.

The first task undertaken by staff hired by the Commission was an attempt to identify all schools in the state at risk. As you are no doubt aware, asbestos was used for fireproofing, soundproofing, accoustical control and even decorative purposes. It was generally applied as part of a spray-on coating. Based on the known literature and contacts with architects, asbestos suppliers and construction companies, it was decided that all schools built or significantly renovated between 1946-1973 would be examined. A limited survey conducted by Rep. Pines had disclosed that, in many cases, architects and/or construction companies who had participated in school buildings were either no longer in business or unable to determine from their records whether asbestos had in fact been used in a particular building. It was, therefore, decided that each at risk school would have to be physically inspected by trained personnel, a task which was exceeded only by the difficulty of first determining what schools meet the at risk criteria.

Although several avenues were pursued, including letters to each school district, the method which proved most accurate was an examination of records of the School Building Assistance Bureau in the State Department of Education. As the state funding mechanism for reimbursing towns for the costs of educational construction, their records were the most complete and accurate. The difficulty of this task should not be minimized, however.

Massachusetts has just over 2400 public schools, of which 1400 were determined by our survey to be at risk. Once these schools were identified, inspectors from DIS began conducting walk-through inspections. School superintendents were advised in advance of the commission work and purpose and were advised that inspectors would be visiting their schools.

Inspectors were given a four page questionnaire, a copy of which is attached, (Appendix C) to fill out which provided information which might be needed to evaluate a potential hazard after further data had been analyzed.

Where spray-on coatings were discovered, bulk samples were taken and returned with the questionnaire to the commission staff. Among the pieces of information collected were the location, accessibility, condition and friability of any spray-on coatings found, as well as pertinent structural and mechanical data.

Bulk samples returned by DIS inspectors are then subjected to analysis by electron microscopy (EM) and either phase contrast microscopy or infrared spectrophotomotry. In the event of a positive asbestos identification, the staff will conduct air sampling in several locations within the school. Samples are collected over a four hour, high activity period of time with Gast vacuum pumps at a rate of 10 liters of air per minute.

Air sampling data in and of itself is an invaluable tool in quantifying the level of asbestos exposure over an extended period of time. The significance of any particular level and the measuring techniques which are most accurate and appropriate are, however, the subject of much discussion and dispute.

The most commonly recognized standards are as a rule measured in fibers per cubic centimeter (f/cc). While the current OSHA standard is presently 2.0 f/cc, the proposed standard is 0.5 f/cc, and the level recommended by NIOSH is .1. Action levels which would trigger employer obligations such as health examination for workers are half the stated figures.

The NIOSH standard which, unlike the OSHA standard, is developed without regard for political or economic implications, and would undoubtedly be lower if the analytical techniques available were to become more uniform, accurate and reliable. It is highly questionable whether any exposure to a known carcinogen can be deemed acceptable.

Aware of the limitation of technology, but cognizant of the increasing medical evidence that exposure to even low levels of asbestos is potentially dangerous, the commission agreed that levels of 0.04 f/cc or above would by itself trigger a review by the standards subcommittee of all the data compiled on an individual school.

This standard closely approximates and is probably scientifically indistinguishable from the 0.05 f/cc which would represent the action level under the recommended NIOSH standard. It also represents a level twice that detected in schools where no immediate asbestos sources existed.

Our analysis of air samples are conducted by phase contrast microscope, using the standard OSHA method. While several experts in the asbestos field now employ EM analysis of air samples to insure that only asbestos fibers are counted, such a method is simply not yet appropriate for our tasks for three reasons: (1) the epidemiological data which exists in the asbestos area are stated in f/cc and there is not correlation between these figures and the nanograms per cubic meter measured by the EM, (2) the EM method is non-standard and results in gross variations from lab to lab, and (3) it is as much as twenty times more expensive as the phase contrast method.

In short the phase contrast method is an accepted analytical production method while the EM, although a valuable research tool, need be further refined before it would prove suitable for a survey of this magnitude.

Neither air sampling technique, however, reflects high levels of exposure which often result for a short period after asbestos material has been disturbed. Simulated experiments have shown that these levels often exceed even the present 2.0 OSHA standard for some period of time.

In order to detect schools where such high peak exposures might well be taking place, and to uncover conditions which are unlikely to quickly deteriorate, a method was developed to independently evaluate schools on the basis of the asbestos content of the material, its condition, friability and accessibility, and the type of air system employed.

An explanation of this method, which was dubbed the Ferris Index, is appended (Appendix D). Any school which had air sampling levels above .04 f/cc or received a high Ferris index number were reviewed both by the subcommittee and full commission before a recommendation was made.

To date, the commission has completed over 1200 walk-through surveys and had made final recommendations to over 80 percent of the 1400 at-risk schools in the State. 206 schools had spray-on coatings, and 68 were found to have spray-on coatings containing no asbestos. 138, or 11.3 percent of those surveyed did in fact contain asbestos spray-on material. Forty one schools were instructed to resurvey in one year and 25 schools to resurvey in three years.

The commission has recommended that 27 schools take immediate corrective action to eliminate the asbestos hazard. Each of these schools received from the commission a listing of those areas in which asbestos was found with a recommendation based on specific conditions as to whether the material should be removed, encapsulated or enclosed. Two schools were found to have air sample levels in the 0.1-o.15 f/cc range. One has been closed at commission urging, and temporary measures to bring levels under control have been instituted at the second.

In general, the response of local systems and communities to commission efforts and recommendations has been constructive and positive. The commission work, however, represents only the beginning to a community with a problem school. Many affected areas have reacted by engaging environmental health specialists to further identify the scope of the hazard, and hiring architects and/or engineers to provide input on possible solutions.

An increasing amount of staff time is now being spent advising communities in the process of responding to an identified asbestos problem. To meet a particularly serious need, we have prepared a draft of suggested bid specifications for contractual asbestos related work. (See Appendix D).

The most overriding concern, though, has, of course, been that of cost. What little resistance we have encountered has been almost the exclusive result of concern over the financial commitment corrective action necessitates. The commission is cognizant of the fact that many localities may be reluctant or even unable to raise the needed funds.

It also recognizes that the problem is only in a very narrow sense a local one and that the State and ultimately the Federal Government will have to provide assistance if meaningful solutions are to be implemented on a large scale.

As a first step, it has introduced legislation in the 1979 Massachusetts Legislature to fully reimburse communities who, pursuant to commission recommendations, undertake acceptable corrective action.

Unfortunately, all too little is presently known about the costs of control. There are very few contractors who currently possess the ability to accurately estimate and successfully execute contracts for asbestos removal or encapsulation. While EPA-commissioned studies by the Batelle Institute seem to suggest encapsulation costs of approximately $2.90/sq. ft., the studies are not yet completed.

And although a removal job at Salem State College in Salem, Massachusetts was bid at $5 a square foot, the contractor, having completed the job, is demanding almost double that figure because of unexpected costs. Current best estimates for removal are $4.50 and up, exclusive of the cost of replacement material.

What is clear is that the commission, the State of Massachusetts, other States and the Federal Government, have just begun to scratch the surface in identifying, let alone rectifying, the problem of asbestos exposure.

Despite the recent rash of publicity, the long latency period of asbestos-related illnesses will continue to hamper efforts to explore, explain, and eliminate asbestos exposure and the diseases to which it gives rise.

The difficulty in obtaining necessary funding, particularly in the absence of a genuine Federal commitment to programs such as ours in Massachusetts, is likely to become even greater as State and local government retrench and reorder priorities. In the face of such pressures, the choice is both a hard and clear one. Either we devote the resources necessary to adequately address the problem now or we will be forced to pay the costs of our neglect in increased health costs, human suffering, and deaths in the years ahead.

[The attachments to Mr. Husid's statement follow:]

HOUSE . . . . No. 5344

The Commonwealth of Massachusetts

REPORT

of the

SPECIAL COMMISSION

Relative to

EVALUATING THE EXTENT OF THE USE OF ASBESTOS AS FIREPROOFING IN THE SCHOOLS AND PUBLIC BUILDINGS OF THE COMMONWEALTH AND ITS CONTAINMENT AND REMOVAL.

(Under Chapter 58 of the Resolves of 1975
and as most recently revived by
Chapter 1 of the Resolves of 1976.)

December 29, 1976

FOREWORD

The Special Commission on Asbestos held an organizational meeting in June, 1976. At that meeting, a need was identified to search for a source of funding for its projects.

To date, the Commission's efforts have been largely unsuccessful. Most of the government agencies contacted were unable to offer assistance because our interests lie outside the agencies' purview. The Environmental Protection Agency (EPA) is not concerned with schools or residential buildings. The Department of Housing and Urban Development is concerned only with residential construction, and more directly with that insured under the HUD/FHA mortgage program. The Occupational Safety and Health Administration's purview extends to the employment sector of the economy and is therefore not concerned with the public domain. The National Institutes of Health (NIH), however, provide research grants for some projects but competition is intense. Our progress in writing the grant proposal will be discussed below.

The Commission also looked into the possibility of getting private foundation support. Among the organizations contacted were the American Association for Cancer Research, the National Research Council, the John Muir Institute for Environmental Studies, the Rachel Carson Trust for the Living Environment, and several local foundations concerned with children's diseases and public health. Most of them referred us back to the same federal agencies we had already contacted.

The Advanced Environmental Research and Technology Program of the National Science Foundation was also mentioned as a potential source. But like the NIH, a research grant proposal is necessary. To be considered for such support, it is imperative to incorporate a technical research component in our study. A simple survey of schools and public buildings to measure asbestos levels is not presently fundable from outside sources. Therefore, to identify possible technical research, a literature search was conducted by the Commission staff. The report is currently under review by prominent researchers in the field. The final draft of the report follows.

In an effort to make a preliminary examination of asbestos contamination in Massachusetts, a survey was conducted of over one hundred schools in the Commonwealth. We included mainly schools with large enrollments. Elementary, as well as high schools, were surveyed by requesting information from the architects on whether asbestos had been specified in the construction plans. The results are presented below. Of the responses received, seventeen of the schools were identified to have asbestos specifications of some kind. Thus, if the sample is representative, approximately 1 out of every 5 school buildings constructed in the fifties and sixties represents a potential hazard to the thousands of school children who daily attend them.

	Number of Schools	Percentage	Percentage of Responses Received
No Asbestos	34	32.4	72.3
Asbestos	8	7.6	17.0
No Answer[1]	58	55.2	——
Questionable[2]	5	4.8	10.6
	105	100.0	99.9

[1] Includes letters returned with addresses unknown.

[2] Some architects used asbestos but covered it with non-asbestos materials. Others did not know if asbestos had been used.

The cooperation of various branches of state government has been helpful in our attempt to expand the survey beyond schools to all public buildings constructed in the Commonwealth during the period of time when asbestos was a widely used construction material. The search for funding for this and other activities will continue.

In addition, the commission is proceeding in its attempt to determine: (1) the merits of a zero-base level of asbestos emissions; (2) the health hazards of low level asbestos pollution; and (3) the feasibility of a uniform measurement technique.

Once the commission is successful in isolating those buildings where the hazard exists, corrective measures will obviously be necessary. Thus the commission is currently addressing itself to developing recommendations and procedures for eliminating asbestos contamination.

It must be emphasized that the harmful and deadly effects of asbestos may take many years and even decades to present themselves. Children now inhaling fibers conceivably will not show symptoms until they are middle-aged adults. As a result, the problems currently created by asbestos may not seem as pressing as other health hazards. Without the presence and work of the commission the warnings of asbestos contamination might well go unheeded. This makes it all the more imperative that the commission be given the resources to complete its task now so that we will not be forced to pay the cost of our neglect in increased health costs, human suffering, and death in the years ahead.

The necessary legislation to continue the existence of the commission has been introduced into the Legislature. It is the unanimous recommendation of the members that the work of the commission be carried on.

The commission would like to express its gratitude to Doug Gilbert, a Science Research Network Intern, for the time and effort he has devoted to the commission.

APPENDIX B

NICHOLAS ROUSSOS
COMMISSIONER

The Commonwealth of Massachusetts
Executive Office of Manpower Affairs
Department of Labor and Industries
Division of Occupational Hygiene
39 Boylston Street, Boston 02116

April 27, 1976

The Honorable Lois G. Pines
State House Room 236
Boston, Mass. 02133

Dear Representative Pines:

In accordance with your request, I have prepared a one-year budget necessary for a survey to determine the extent of hazard resulting from the use of asbestos as fireproofing in schools and public buildings of the Commonwealth.

The amount of money needed would run between $90,000 - 100,000 for the year.

The details of the annual budget are as follows:

ANNUAL BUDGET

1. Personnel Services

1 Senior Engineer - 12 months - Grade 19	$15,000	
1 Asst. Engineer - 12 months - Grade 17	13,000	
3 Asst. Engineers - 10 months - Grade 17	33,000	
1 Senior Clerk-Steno - 12 months - Grade 8	7,200	
		$68,200

2. Travel

2 Engineers @ 800 miles/month/12 months @ 12¢/mile	2,300	
3 Engineers @ 800 miles/month/10 months @ 12¢/mile	2,900	
		5,200

3. Equipment

a. Personal protective - 5 respirators @ $15.00	75.	
b. Technical Equipment		
1. - Phase Contrast Microscope with Camera	2600	
4 - Personal Sampling Pumps @ $275.00	1100	
8 - Hi-Volume Sampling pumps @ 150.00	1200	
8 - Particulate Samplers 25l/min @ 315.00	2520	
1 - Thermo-anemometer 475.00	475	
8 - 25' Extension Cords @ 6.25	50	
		$8,020

c. Office Equipment

Photocopier @ $125/month for 12 months (50% utilization)	750	
2 - Locked 4 drawer vertical steel files	200	
		$950

4. Supplies

a. Office Supplies		
5 Engineers @ 100	500	
b. Technical Supplies		
AA Filters for Personal Sampling Pumps	300	
100 Cassettes holders for filters	75	
AA Filters for Hi-Volume Sampling Pumps	40	
Chemicals	25	
Film, slides, etc.	100	
		$1040

5. Other Costs

Text books, manuals, etc.	100	
Telephone @ 100/month	1200	
Postage	350	
Space requirements	2000	
5 Desks @ 150	750	
1 Typewriter	250	
		$4650

TOTAL $88.060

Very truly yours,

Harold Bavley

Harold Bavley, P. E.
DIRECTOR

HB:ry

March 10, 1978

To: Commissioner Nicholas Roussos
From: Director Harold Bavley
Subject: Requested Change for 1979 Budget, for the Asbestos Commission Project

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At the meeting of the Legislative Asbestos Commission on March 9, 1978, the Asbestos Commission reviewed the proposed Budget #9020-3005, which was originally submitted prior to beginning the actual work on the program.

In view of the scope of the program which involves investigation of spray-on insulation to determine the potential asbestos hazard in schools and public buildings, it was concluded that the proposed budget was inadequate to meet the needs of the program.

During fiscal year 1978, the Department of Labor and Industries donated approximately $150,000. in man hours, supplies and rental, which was not anticipated when the program was organized. The original estimate was that there were approximately 350 schools which would be investigated as to the potential asbestos hazard. The survey work performed during fiscal 1978, revealed that at least 1400 schools would be involved in the survey.

In order to complete the survey of public schools only, it will be necessary to increase the budget by an additional $57,125. for a total of $107,125.

It will be necessary to provide 3 additional technical and 1 additional clerical position to complete the public school survey without requiring further extensive donations by the Department of Labor and Industries.

The increase will be as follows:

Subsidiary	Amount
03	$94,804.00
06	36.00
07	2,200.00
10	4,000.00
12	400.00
14	1,360.00
15	3,075.00
16	1,250.00
	$107,125.00

The above budget is considered an absolute minimum to accomplish the program required by the Asbestos Commission.

APPENDIX C

MASSACHUSETTS DEPARTMENT OF LABOR AND INDUSTRIES
DIVISION OF OCCUPATIONAL HYGIENE
SPECIAL ASBESTOS STUDY

Date of Survey:

Code No. ____________________

ASBESTOS USE IN SCHOOLS
Phase II Inspection

I. General Information

A. School name and address:

B. Building name (if more than one):

C. Year of construction:

D. School contact:

E. Past uses of building, if different from present use, with years of use:

F. Prior asbestos surveys, including date, results, and action taken:
(attach copies of survey report)

II. Current Use

Grades taught: ____________________ No. of students: ____________________

Hours of classes: ____________________ No. of staff: ____________________

Special rooms (gym, pool, kitchen, vocational school rooms ---):

Special uses (evening school, adult educ., movies, plays---)
(Looking for number of potentially exposed people)

III. Construction

A. Structural Information

1. No. of floors: ______________ Is there a basement? ______________

2. Material of foundation: ______________________________

Material of bearing walls: ______________________________

Material of bearing floor: ______________________________

Material of bearing roof: ______________________________

3. Is structural steel used? ______________________________

4. Do windows open? ______________________________

5. Type of thermal insulation, if any: ______________________________

B. Interior Finish

1. What is the material of the exposed:
   Floors: ____________________

   Ceilings: ____________________

   Draperies: ____________________

   Fire Curtains: ____________________

2. Are there suspended ceilings? ____________________

   Where? ____________________

3. What type, and where is acoustical material: ____________________

C. Is there a "Spray-on" coating? ____________________

1. Where? ____________________

2. What is the square footage? ____________________

3. How much is exposed? ____________________

4. How much is covered by suspended ceilings? ____________________

5. Is it part of an air moving system (air plenum)? ____________________

6. What is it sprayed onto (lath, steel ---)? ____________________

7. Has it undergone any treatment (painting, sealing---)? ____________________

8. What is it's condition? ____________________

9. How accessable is it? ____________________

10. At what height is it? ____________________

IV. Mechanicals

A. What type of heat? ____________________

   What type of air conditioning? ____________________

B. What material is used for:
1. Inside air conditioning ducts? ____________________

2. Boiler insulation? ____________________

3. Pipe lagging? ____________________

C. Are there concealed spaces (i.e. ducts for sound absorbing --) ____________________

V. Exposure

A. Land vibration, settling

1. Kind of land built on (filled, ledge---): ____________________

2. Surrounding area (nearby industrial plants, nearby sanitary landfill, local traffic patterns, ---) ____________________

B. Is asbestos a nearby industrial raw material? ____________________

VI. Remarks

A. Physical appearance of "spray-on" coating, where it is; enclose a photograph if possible:

VII. Bulk Sample

Identification number	Where it was taken

VIII. Sketch to scale, use back of sheet if necessary, a plan of the building, indicating the square footage and location of all "spray-on" coatings.

Name of Inspector: ____________________

Signature: ____________________

COMMONWEALTH OF MASSACHUSETTS, SPECIAL LEGISLATIVE COMMISSION ON ASBESTOS
DEPARTMENT OF LABOR AND INDUSTRIES, DIVISION OF OCCUPATIONAL HYGIENE
39 Boylston Street, Boston 02116

NUMERICAL RATING FORM

Check one space only for each category.

As regards the "spray-on" coating ---

1. Condition
   1) ( ) No damage at all, condition is very good.
   2) ( ) Mild damage.
   3) ( ) Moderate damage.
   4) ( ) Severe damage - many areas have fallen or are hanging loosely or have water damage, etc.
2. Accessibility
   1) ( ) It is totally enclosed (for example by a suspended ceiling.)
   2) ( ) Inaccessible - beyond reach of the population.
   3) ( ) Accessible, but in low activity areas (all rooms other than in 4.)
   4) ( ) Accessible in high activity areas (gymnasium, cafeteria, hallways, and stairwells.)
3. Friability - or ease of crumbling
   1) ( ) Nonfriable or firmly bound.
   2) ( ) Slightly friable.
   3) ( ) Moderately friable.
   4) ( ) Very friable - breaks apart or flakes off with little or no touching.
4. Is it part of an air moving system (plenum, inside ducts)?
   1) ( ) No
   2) ( ) Yes

APPENDIX D

FERRIS INDEX

POTENTIAL HAZARD INDEX FOR SPRAYED ASBESTOS COATINGS

Asbestos dust from sprayed asbestos coatings is a function of several factors. These factors are considered separately, rated, and a combined index generated to describe the potential hazard.

A. Condition--After some time has elapsed, deterioration may occur in the coating which is visually evaluated. No consideration is given as to how the damage occurred.

1.= No apparent deterioration.
2.= Slight deterioration.
3.= Many areas of small change.
4.= Severe damage and falls.

B. Friability--A qualitative determination of the ability of the material to crumble and be an airborne dust.

1.= Very hard--requires tools and force to dust.
2.= Hard but will dust under mild fingernail probe.
3.= Soft but gummy.
4.= Soft and crush in fingers.

C. Accessibility--A measure of occupant activity and location of the coating.

1.= Totally enclosed and sealed off.
2.= Partially enclosed, e.g., suspended ceiling.
3.= Open but above ten feet.
4.= Open--gyms, halls and stairwells, cafeterias, etc.

D. Air System

1.= Coating not a part of HVAC system.
2.= Coating in extended part of air handling system.

E. Asbestos content--A classification of per cent of asbestos

0=Less than 1%

1=1-10%

2=10-25%

3=25-50%

4=Greater than 50%

Potential Hazard Index = (Condition + Friability + Accessibility + Air System) x (Asbestos Content)

Recommendations for Normal Occupancy

Index--
0--No asbestos--no hazard

1-4--No significant hazard

5-9--Review in 3 years for evidence of deterioration

10-15--Review in 1 year " " " "

16-20--Individual review to place in another category

21 and Over--Recommend control measures

Exceptions

A. When condition is so bad, or other renovations are to be made, make appropriate control measures for the work.

B. An existing suspended ceiling does provide adequate control for normal occupancy. Not recommended as permanent control.

Guidelines for Control Measures

A. Removal

B. Encapsulation

C. Enclosure

APPENDIX E

RECOMMENDED SAFE PRACTICES

DRAFT.

SUGGESTED BID SPECIFICATIONS FOR CONTRACTUAL ASBESTOS RELATED WORK

REFERENCE: Mineral Safety Data Sheet #2 "Asbestos".

Introduction: The purchaser of contract services is advised to establish controls to minimize asbestos exposure to prevent building contamination and to protect building occupants. Once the contractor leaves the job site there are currently no regulations protecting the building owners. To ensure proper clean-up performance by the contractor, the purchaser of the contract services should provide the contractor with definitive job specifications for asbestos related work. Such specifications essentially restrict bidding to those contractors who know the work and regulations, and are prepared to do a thorough job. The written contract should detail work activities which comply with EPA, OSHA and Mass. Division of Labor & Industries regulations. In addition, bonding is desirable to insure appropriate compliance with the contract and completion within the scheduled time period. Before the asbestos related work commences, a pre-bid meeting should be attended by all key project personnel. The following are suggested specifications which should be included in the contract for the proposed asbestos work:

SUGGESTED SPECIFICATIONS FOR PROPOSED ASBESTOS WORK

Applicable Regulations: The contractor shall comply with EPA and OSHA regulations for work practices involving the handling, renovation and/or removal of asbestos containing material. The following publications are applicable:

(1) Occupational Safety and Health Standards (29 CFR 1910) in general, and specifically, Section 1910.1001.

(2) Environmental Protection Agency regulations contained in Title 40 (CFR Part 61, Subpart B, as amended, as applicable to asbestos).

(3) Mass. Dept. of Labor, Bulletins 1, 2, 12 and 13.

Notification: The contractor shall notify the Massachusetts Department of Labor and Industries, Division of Occupational Hygiene, ten (10) days in advance of the commencement of the work project.

The contractor shall notify the Massachusetts Department of Environmental Quality Engineering, Division of Air and Hazardous Materials twenty (20) days in advance of the commencement of the work.

Permits: It is the responsibility of the contractor to secure all the necessary permits for the asbestos related work, including hauling, removal, and disposal. The contractor is also responsible for timely notification of such actions, as may be required by the Federal, State, regional, and local authorities. Matters of interpretation of these standards shall be submitted by the contractor to the respective administrative agency for resolution before starting the work.

Submittals: The purchaser will specify the time table necessary for the operation to proceed smoothly and be completed in a reasonable period. The contractor will then submit a detailed construction schedule describing the phasing, sequencing and interfacing of all the trades involved in the asbestos related work. The construction schedule, and compliance with its dates is mandatory.

Worker Protection:

(1) Equipment: The contractor shall furnish all the equipment, tools and special clothing necessary to perform the work in a safe and expeditious manner. Power equipment shall conform to OSHA standards.

(2) Clothing: Workers shall wear special whole body clothing, head and foot coverings. Asbestos contaminated clothing shall be disposed of as an asbestos waste product, or a special procedure may be followed to launder them, (29 CFR 1910.1001). Eye protection and hard hats shall be provided as appropriate. All disposable clothing must be fire retardant.

(3) Respirators: Workers are to be provided with respiratory equipment. The respirators are to be sanitized and maintained according to the manufacturer's specifications. Appropriate respirator selection is dependent upon the intensity of the asbestos exposure. OSHA guidelines for respirator selection are outlined below:

(a) An air purifying respirator is to be used when the 8-hour TWA is not more than 20 fibers per cubic centimeter of air.

(b) Powered air purifying respirators are to be used when the 8-hour TWA is greater than 20 fibers, but less than 200 fibers per cubic centimeter of air.

(c) A type "C" continuous flow or pressure-demand supplied air respirator is to be used when the 8-hour TWA is greater than 200 fibers per cubic centimeter of air.

Note: Respirators may be used for exposures lower than their rated protection.

Medical: Medical examinations must be performed and medical records kept in accordance with the OSHA regulations and made available to the Division of Occupational Hygiene. In addition, the contractor shall furnish proof that employees have had instruction on the hazards of asbestos exposure, on the respirator use, decontamination and OSHA regulations.

Personal Hygiene: All workers without exception:

(1) Will change work clothes at designated areas prior to starting the day's work. Separate lockers or acceptable substitutes will be provided by the contractor for street and work clothes.

(2) All work clothes shall be removed in the work access area prior to the departure from this area. Workers will then proceed to the showers. Workers will shower at the end of each work day. Hot water, towels, soap, and hygienic conditions are the responsibility of the contractor.

(3) No smoking, eating or drinking is to take place beyond the established clean room at the work site. Prior to smoking, eating, or drinking, workers will be fully decontaminated. Each worker will then dress in clean coveralls to eat, drink, or smoke. These new coveralls can then be worn back onto the work area

(4) Work footwear will remain inside the work area until the completion of the job.

Security Program:

(1) The building must be closed to the public. A security system must be established so that only authorized personnel can enter the asbestos job site.

(2) Caution signs are to be posted at all work locations. These signs must conform to OSHA regulations. (29 CFR 1910.1001).

(3) A security guard is to be stationed at the entrance to the building.

(4) Emergency exits shall be maintained, or alternate exits provided, during construction.

Work Procedures and Practices:

(1) The purchaser of the contract services and the contractor should inspect the present condition of the walls, floors, ceiling, and other fixtures in the work area. The contractor is responsible for any damage that occurs as a result of the asbestos related work project.

(2) Isolation of the work area ventilation system is carried out first to prevent contamination and fiber dispersal to other areas of the building during the work phase.

(3) All moveable objects present in the proposed work area must be transferred to a new location outside the proposed work area. Anything remaining in the work area must then be sealed with polyethylene sheeting.

(4) The asbestos work area must be isolated from the rest of the building, and access restricted to the site according to OSHA regulations. This is accomplished by sealing corridors and entry ways with polyethylene plastic barriers.

(5) Setting up the Enclosures:

A major effort must be undertaken to ensure that the asbestos fibers are confined at the work site and that all surfaces are free of asbestos accumulation when the work is completed. This is accomplished by creating a series of four specially designed chambers;

(i) Work Space: The handling, renovation and/or removal of asbestos must be confined to this space. All surfaces (excluding the asbestos sprayed-on coating itself) must be protected from contamination with polyethylene sheets of 6 mil. or greater thickness. All edges must be taped securely. All walls, floors, furnishings, diffusers, grilles and air conditioning units must be covered and sealed. All workers must remove gross contamination from their clothing before leaving this area.

(ii) Equipment and Access Area: This area is designated for equipment storage and access to the work space. Workers must remove all protective clothing, except for their respirators in this area. All surfaces shall be covered with polyethylene as described for the work space.

(iii) Shower Room: Workers will remove respirators and shower in this area.

(iv) Clean Room: This area is to be kept free from asbestos contamination. All street clothes must be kept in the confines of this space. At the beginning of the work cycle, workers will change into clean protective clothing in this area. At the end of the work cycle, workers dress in this area after showering.

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(6) If, at any time, air monitoring shows that areas outside the sealed plastic enclosures have 8-hour TWA's above the background level of 0.04 fibers/cc, these contaminated areas must be enclosed. They will then have to be maintained and cleaned in the same manner as the work space.

(7) Removal of ceiling mounted objects such as lights, partitions, and other fixtures must precede the actual asbestos related work. This will usually result in contact with the ceiling, creating potentially hazardous asbestos exposures. Localized water spraying during fixture removal must be used to reduce fiber dispersal. Protective clothing and an air purifying respirator must be worn.

(8) Before asbestos material is handled, it must be sprayed with water containing a ~~wetting a~~ wetting agent to prevent excessive dispersal of asbestos fibers. The sprayed on material should be wet repeatedly during the work process to minimize asbestos fiber dispersion.

(9) In work projects that require a great deal of water for wetting the asbestos-containing material, 24 volt safety lighting must be used in lieu of the building's own lighting system.

(10) All asbestos and asbestos-contaminated waste material shall be sealed in 55 gallon drums lined with polyethylene plastic bags with a thickness of 6 mil. or greater. The drums are to be labelled, transported and disposed of in accordance with the applicable OSHA and EPA regulations. At the conclusion of the job, all polyethelyne material, tape, cleaning material, and clothing will be placed in the plastic lined drums, sealed, correctly labeled, and disposed of as asbestos waste material.

(11) All equipment including plywood, scaffolding and planks will be cleaned of asbestos material prior to leaving the work area.

Air Monitoring: Air sampling must be conducted during related asbestos work and cleaning phase to ensure that the contractor is complying with all codes, regulations and ordinances. The sampling methods to be used at the job site are described in OSHA 1910.1001

All air monitoring must be in compliance with the NIOSH approved method for asbestos sampling. Air monitoring will be performed to provide the following samples during the period of the asbestos related work:

Suggested Sampling:

Area to be Sampled	Number of Sampled	Minimum Sample Volume in Liters
Workers	4/240 man hours	As appropriate
Outside work area barriers	4/240 man hours	2000

These samples will be used to determine worker exposure to asbestos for the purpose of selecting the appropriate respirator. They will also be used to determine if the asbestos material has been successfully contained in the work area, or if additional sealed enclosures need to be constructed to contain the material.

Clean-up:

(1) When the work is finished, it is the contractor's responsibility to clean the area to a safe level.

(2) All debris shall be cleaned up and deposited in the drums designated for asbestos waste.

(3) All surfaces shall be wet mopped.

(4) The area shall be fogged.

(5) Twenty four hours after fogging, air samples are to be taken in and around the work enclosure; (minimum of 1200 liters of air per sample). Sampling must be taken outside all work areas that abut a clean area. A small fan is used during the sampling to circulate the air and simulate occupant activity.

(6) The fiber /cc count for all samples must be 0.04 or lower after the contractor has cleaned the work areas. If the samples are not 0.04 or lower the contractor must

repeatedly clean and sample until the levels meet this criterion.

(7) Until the 0.04 fibers per cc level is attained, the polyethylene plastic enclosures shall remain in place. Occupants shall not be allowed to enter the building until the air sampling levels are deemed acceptable by the purchaser.

(8) The plastic enclosures shall be removed and properly disposed of after the area is clean.

Specific Work to Be Performed: The purchaser and the contractor must agree on the specific work to be performed. If the spray-on material is to be removed, encapsulated, or enclosed, the contract should so state. The plastic enclosed areas, locker and shower facilities and access areas and hallways should be defined in the contract. If the job is to be completed in discrete sections, the contract should state the order of completion of the projects. If finish work is to take place after the asbestos related work is completed the contract should include provisions for the scheduling for this also. The contractor is responsible for making sure that all areas have air sampling levels ~~of~~ UNDER 0.04 fibers/cc before further non-asbestos related work proceeds in the area.

IF, AT ANY TIME, THE PURCHASER'S REPRESENTATIVE DECIDES THAT THE WORK PRACTICES ARE VIOLATING PERTINENT REGULATIONS OR ENDANGERING WORKERS, HE WILL IMMEDIATELY NOTIFY IN WRITING THE ON-SITE CONTRACTOR REPRESENTATIVE THAT OPERATIONS SHALL CEASE UNTIL CORRECTIVE ACTION IS TAKEN.

Mr. MILLER. Thank you.

Dr. Preuss?

STATEMENT OF DR. PETER PREUSS, DIRECTOR OF TOXIC SUBSTANCES PROGRAM, DEPARTMENT OF ENVIRONMENTAL PROTECTION, STATE OF NEW JERSEY

Dr. PREUSS. Thank you, Mr. Chairman.

Members of the subcommittee, ladies and gentlemen, my name is Peter Preuss. I am a Special Assistant to the Commissioner of the New Jersey Department of Environmental Protection (DEP) and Director of the Department's Toxic Substances Program.

With me today on my left is George Tyler, Director of the Department's Division of Environmental Quality. We are here in response to an invitation from this subcommittee to discuss New Jersey's experience in coping with the hazards presented by the use of asbestos surface coatings in schools and other public buildings.

The dangers presented by asbestos have long been recognized. Numerous occupational studies have demonstrated the increased risk of cancer-particularly lung cancer and mesothelioma associated with exposure to asbestos in the workplace. It is only recently, however, that the release of fibers from asbestos surface coatings has been identified as a potential public health hazard. Today, an ever increasing number of people are becoming aware of the dangers associated with the exposure to asbestos fibers in any form.

To some degree, public awareness regarding the problem of asbestos coatings has been the result of the events taking place in New Jersey during the past two years. During this period we have (1) learned about a large number of problems associated with asbestos exposure; (2) formed an Asbestos Task Force as an adjunct to the Governor's Cabinet Committee on Cancer Control. We have surveyed schools and other public buildings in the State. We have helped initiate a Federal study of sealants, and we have twice petitioned EPA for Federal action. (A copy of Governor Byrne's most recent petition to Administrator Costle concerning this problem has been given to your staff.)

The problem of spray-on asbestos surface coatings was first brought to our attention through two separate events occurring in the late summer and early fall of 1976. The first instance concerned two residents of a 1300 unit condominium complex who initiated a lawsuit when they learned that a paint-like ceiling coating which contained between 25 and 40 percent asbestos by weight had been used in their homes.

DEP retained the services of the Mount Sinai Medical School, Environmental Sciences Laboratory, for the purpose of conducting detailed, on-site testing, and to determine if serious health consequences to the residents might be expected.

In this case the buildings were constructed after the Federal EPA regulation banning spray-on asbestos surface coatings for insulation or fireproofing had become effective. Here, however, the coatings were found (by EPA) to be decorative in nature and, therefore, considered exempt from the rule.

In another, more publicized case, a DEP employee with children at a Howell Township School, took samples from a ceiling which he suspected of containing asbestos. The samples were sent to EPA in September of 1976. By early November we received the results of the EPA analysis which confirmed the presence of asbestos in the ceiling material.

This was followed by a longer series of meetings over the next six weeks with local and State officials where we attempted to reach a decision as to what needed to be done. Our department strongly urged that the ceilings be removed.

Shortly after, the school board decided to remove the damaged ceilings. A letter was sent to all county and local school superintendents urging them to survey all school buildings in their districts and to remove all sprayed-on asbestos that appeared to be in a damaged state. Our department prepared a guidance document for use by the schools which briefly discussed the health effects of exposure to asbestos, methods of identifying the material, and proper removal procedures. I have appended that guidance document as well to my testimony. (Appendix 1).

Now the events which I have just outlined culminated in a cabinet meeting called by Governor Byrne on January 7, 1977. Several significant developments took place as a result of the Governor's action.

Specifically, Governor Byrne directed us to initiate a State rulemaking which would ban the use of all spray-on asbestos coatings in New Jersey, including those exempt from the EPA rule.

Also in January of 1977, Governor Byrne petitioned EPA to amend their existing regulations to do the same nationwide. By June of 1977 the State of New Jersey had issued regulations prohibiting the use of any spray-on materials containing more than .25 percent asbestos.

One year later, by June of 1978, EPA had amended its existing regulations to achieve a similar end, that is, an effective national ban of asbestos-containing spray-on decorative materials.

In addition, the Governor formed an Asbestos Task Force as an adjunct to his previously established Cabinet Committee on Cancer Control. This task force has since supervised a study of public buildings in New Jersey and the removal or treatment of asbestos ceilings in numerous cases. To date, we have discovered that 250 school buildings, or 10 percent of the total number of schools in our State, have made use of spray-on asbestos coatings in some form.

Of these 250 schools, some 30 have actually removed the asbestos-containing materials, and several others have experimented with various types of sealants as an alternative to the complex and costly process of removal.

Since 1977 the New Jersey Departments of Health and Environmental Protection have provided technical support to building operators, local government officials, and the public in general in cases where asbestos ceilings have been discovered.

To date, numerous cases have been dealt with in schools, institutions and other buildings.

In addition, as a result of the asbestos problems found in New Jersey, the National Institute of Environmental Health Sciences sponsored a study of the asbestos problem in New Jersey school buildings. That study, prompted by a request from New Jersey Congressman Andrew Maguire, was carried out by the Mt. Sinai School of Medicine, Environmental Sciences Laboratory. The school study, along with the guidance document, have been widely distributed throughout the State and the nation.

I should say parenthetically that when information became available that our guidance document was available, I received calls from throughout the United States, Canada and Mexico. More recently, a guidance document prepared by EPA has also become available.

Now recently all these things I have described culminated in Governor Byrne's petition of September 18, 1978 to EPA. In that petition, the Governor urged the promulgation of a . . ."Federal rule requiring the removal of asbestos-containing surface coatings already in place where their deterioration could produce dangerous levels of asbestos fibers in the environment."

The position that we have taken, and the policy that we have adopted, is simple and straightforward, any exposure to asbestos fibers in a classroom as a result of fiber release from ceiling materials is totally unnecessary and should be eliminated.

The need for remedial action is premised on a finding that asbestos is present in friable ceiling materials and is available for ready release due to vandalism or even simple routine activities.

The guidance document I mentioned earlier states: "If the coating can readily be or has been appreciably physically disturbed, is in a degraded state (e.g. due to age or activity) and contains asbestos, then there is a potential for significant exposure to asbestos fibers. This combination of conditions calls for immediate action to remove the material."

I emphasize that we are dealing with sprayed-on asbestos materials, not ceiling and floor tiles.

The situation to date, summarizing Federal activities, is that EPA has partially responded to New Jersey's initial petition, and is now reviewing our second petition, that NIEHS has completed a study on asbestos in school ceilings, that EPA has issued a guidance document for hazard abatement from sprayed-asbestos containing materials, and that EPA has a study under way to determine whether sealants may or may not be useful for preventing exposure to asbestos under certain circumstances.

For the most part, these actions on the part of the Federal Government have been reactions to problems or petitions. Our efforts in New Jersey have consistently come 6 to 12 months before analogous efforts by Federal agencies. This is due, I am sure, to the ability of States to mobilize their resources more quickly than the Federal Government.

However, having once identified a problem of such magnitude, the States should be able to turn to the Federal Government with its scientific and technical resources and be able to receive the help and guidance that they expect. I strongly support such efforts.

To some extent, the lengthy Federal process is the result of a sincere effort to thoroughy examine and resolve the many issues presented by a problem like asbestos fibers in interior air. Whenever one deals with the concept of environmental carcinogens, many technical, legal, political or policy-type questions arise.

For example, the concept of a safe threshold for asbestos fiber exposure may never be adequately resolved. Similarly, the cost/benefit of eliminating spray-on asbestos surface coatings or, for that matter, the cost/benefit of eliminating exposure to any carcinogen may be impossible to compute accurately.

Nonetheless, Federal agencies routinely engage in attempts to resolve such complex and often near insoluble issues. This, in itself, is commendable. But, again, as you have brought out in previous testimony, inaction pending the outcome of such resolution is not.

In order to abate a hazard such as the presence of asbestos fiber in school room air, it is imperative that these complex issues be reviewed from an extremely practical and straightforward viewpoint. By adopting a posture that any exposure to asbestos fibers in a classroom is totally unnecesary, no matter what the fiber level measured, we have been able to act on a problem prior to ultimate resolution of all the issues it represents.

We have accomplished this goal by analyzing the problem from a simple viewpoint. That is, while the costs of removing an asbestos-bearing ceiling are considerable, they are not prohibitive. In addition, we know that removal can be accomplished without recourse to esoteric technology.

Now it is true it must be very carefully controlled. But it can be done. When these factors are present in any analysis of an environmental carcinogen, action should precede attempts to analyze problems which may well take years to resolve.

Finally, I was asked some questions regarding costs. I would say we have been able to make a rough estimate about what it would cost in New Jersey. As I say, there are about 250 schools that we have found to contain asbestos coatings. They contain about 2-1/2 million square feet of asbestos-containing ceilings.

Using an estimated cost of $5 per square foot for removal and replacement, the cost to New Jersey local school boards would be in excess of $12.5 million. Consequently, I would recommend, and that goes in answer to one of the questions asked before, Congressman, that Congress move expeditiously to enact legislation which would appropriate such sums as are necesasry to assist the States in dealing with this situation.

Congressman Howard of New Jersey introduced just such a bill (H.R. 2587) in January of 1977. Although this bill did not pass the 95th Congress, we sincerely hope that legislation of this type will be enacted by the 96th Congress.

I have been advised today in fact by Congressman Howard's office that he will reintroduce his bill this coming Monday, January 15th.

The recent outbreaks of Legionnaires Disease in New York City and other areas, with the possibility that the disease may be transmitted through air conditioning systems, is a further illustration of the need to place new emphasis on the quality of interior air. It would be helpful if the federal government were to create a task force to review this issue in order to make sure that the attention paid to interior air quality may someday be equivalent to that being paid to the quality of outdoor air.

I would close, Mr. Chairman, with two thoughts:

No. 1, we need guidance from the Federal Government.

No. 2, we need help to accomplish what we set out to do.

I think the documents I have appended, particularly the literature survey from early 1977, point out the fact that the guidance that we have received has generally been much too late for it to really help us.

Thank you very much.

[The attachments to the statement of Dr. Pruess follow:]

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL QUALITY
JOHN FITCH PLAZA, P. O. BOX 2807, TRENTON, N. J. 08625

May/1977

GUIDANCE DOCUMENT
For Eliminating Health Risks from Sprayed-on Asbestos Containing Materials in Buildings

I. PURPOSE

This document is intended to serve two purposes:

A. Supply public officials with information regarding the nature of the problems which may exist as a result of the presence of asbestos in sprayed-on coatings used in buildings and structures under their supervision or control. This document includes information about the health effects of asbestos exposure, the proper identification of those cases where corrective action is warranted and guidance as to the necessary actions required.

B. Explain the proper procedure to be followed when corrective action is warranted and warn against actions that should be avoided. Disregarding these warnings may cause asbestos exposures which are more serious than those encountered if no action at all were taken.

II. BACKGROUND AND HEALTH EFFECTS OF ASBESTOS EXPOSURES

A potential problem exists with sprayed-on coatings which contain asbestos materials. Such coatings have been used in public places, particularly on ceilings. This type of coating, as it ages, has the potential to release asbestos fibers into the air on a continuing basis (fallout). It has been shown that in addition to fallout, significant amounts of asbestos fibers are released when the ceiling is disturbed, either through the performance of maintenance or due to mischief. Another significant source of asbestos fibers results from repeated re-entrainment and disposal from surfaces where the falling asbestos fibers accumulate (such as floors, desks, shelves, etc.). Exposure to asbestos can result in serious human health effects. The use of asbestos coating constitutes an unnecessary exposure to asbestos fibers for members of the general population. New applications of such asbestos containing materials is especially unnecessary in light of the fact that today comparable non-asbestos containing materials and alternate construction techniques are readily available.

Asbestos is a generic term used to describe a number of naturally occurring, fibrous, hydrated mineral silicates. Asbestos is widely recognized as a human carcinogen based on studies of asbestos workers. Asbestos produces a form of cancer known as mesothelioma. It also produces a non-malignant scarring of the lungs known as asbestosis. It has been classified as a hazardous air pollutant by the United States Environmental Protection Agency. Extensive medical studies and research of occupational exposure have confirmed the hazardous nature and carcinogenic effect of asbestos on humans. Recent medical research in this area indicates that brief, high level exposure, as well as long-term, low level exposure, leads to an increased risk of lung cancer. This fact, coupled with the variability of individual response to any carcinogenic agent, makes it impossible to prescribe a safe exposure level for asbestos. Typically no immediate effects are observed, as asbestos related diseases generally have a latency period of from 10 to 20 years.

Exposure to asbestos fibers is not limited to those who come into direct contact with sources. Studies of the families of asbestos factory workers indicate a higher than normal incidence of lung cancer. This has been linked to fibers brought into the home on the clothing of the workers. This has been acknowledged by the federal government in the occupational health standard which requires separate work and street clothes for workers with high exposure to asbestos materials. Once transported into the home, asbestos becomes entrained in the air and in a sense, 24-hour exposure occurs. These family studies suggest that the very young are the most susceptible to the induction of cancer. Here, these facts are especially critical because in our schools and other public buildings, we are dealing with high numbers of young recipients. Every reasonable effort must be made to eliminate such unnecessary human exposure.

III. IDENTIFICATION

A. Ceiling coatings made from sprayed-on asbestos containing materials may have mat-like, or cotton-like, fluffy texture appearance. The thickness of the coating varies typically from 1/8" to 1". The material may be spongy to the touch, is friable (i.e., hand pressure is enough to pulverize it) and readily flakes upon disturbance. When not painted, the color of the material is light gray or brown, depending on age or cleanness.

Sprayed-on asbestos containing materials may also appear to be paint-like or have stucco-like appearance. Surfaces sprayed with this type of asbestos bearing material also has the potential to release fibers into the air.

B. Many products used in construction contain appreciable amounts of asbestos. However, these products are not friable and the asbestos fibers are locked into the material with a strong and firm bond. Therefore, no corrective action is recommended at this time for these products. This category includes ceiling and floor tiles, asbestos pipes, asbestos wrapped pipes and roof shingles.

IV. NECESSARY ACTION

The following recommendations apply to installation which have been identified in Section III(A).

1. The first step is to determine if asbestos is present and what is its percentage in the material in question. A definitive laboratory analysis should be undertaken. A list of some companies having the capability to conduct asbestos analysis is attached in Appendix A. (It should be noted that the State of New Jersey Department of Environmental Protection does not have the facilities to do asbestos analysis.)

Warning! Except for taking the sample for analysis, the sprayed-on surface material should not be disturbed in any way. If possible, the affected area should be closed or activity in the area reduced until the laboratory results are obtained and any necessary corrective actions are completed.

2. Should the laboratory analysis of the sprayed-on surface material prove to be negative, no further action is recommended.

3.A. Should the laboratory analysis of the sprayed-on surface material confirm the presence of asbestos, further information is needed in order to evaluate the urgency of the situation and to determine what is the best way to solve the problem:

- Percentage of asbestos in sprayed-on surface material (results of laboratory test).

- Age, area and thickness of sprayed-on material.

- Physical condition (Has the material been damaged? Is visible flaking of the material evident?).

- Function of affected area (e.g., classroom, cafeteria, gymnasium, hallway corridors, library, boiler and/or incinerator rooms) and accessibility of area to damage (height of ceiling).

" B. If the coating can readily be or has been appreciably physically disturbed, is in a degraded state (e.g. due to age and/or disturbance), is in an area of considerable physical activity, and contains asbestos then there is a potential for significant exposure to asbestos fibers. This combination of conditions calls for immediate action to remove the material. "

C. If no physical disturbance is evident and the material is in a good state, coating the asbestos ceiling with a sealant as an alternative solution to removal can be considered. However, the applied sealant must be maintained in good condition. Also, repair work which may cause the sealant to break or rupture must be strictly controlled as specified in (4) below.

Below is a list of criteria that an acceptable coating sealant has to fulfill:

(1) The sealant must form a layer that is

(a) impermeable to asbestos fibers
(b) resistant to impact

(2) The sealant must penetrate into the asbestos and not merely wet the surface.

(3) The sealant must be non-toxic and should not cause an adverse reaction in people.

(4) The layer formed must age well and not deteriorate quickly (i.e., crack, disintegrate, etc.).

(5) The layer should be lightweight so that it does not shear off the asbestos.

(6) The sealant should be easily applied and cost of application be reasonable.

In addition to the above six criteria, the sealant (and any other replacement work as well) must comply with all laws, regulations and requirements that the original asbestos coating had to comply with (e.g., fireproofing regulations, thermal and acoustical insulation requirements, etc.).

No specific sealant, that fulfills all the above criteria, can presently be recommended. It is suggested that contractors be required to demonstrate that their products meet the specific criteria required for the installation under consideration.

The appropriate corrective action must be determined for each specific situation taking into account the factors listed in 3A above. Not all situations are as clearly defined as those defined in 3B and 3C above. In all decisions, consideration must be given to the protection (short-term and long-term) of all occupants in the building. The enclosed article by Dr. Robert Sawyer gives further guidance in this matter. It should be noted that the only way to completely remove the hazard for all time from a building is to remove the material (see Appendix B).

4. Until corrective action is taken, the necessary maintenance, custodial and repair activities should be strictly controlled to avoid or reduce airborne asbestos contamination:

A. Work should be performed during hours when the building is unoccupied to eliminate exposure of occupants to the dust generated by such activities.

B. Wet cleaning methods should be used rather than dry dusting and sweeping. Vacuum cleaning methods may be employed only if special vacuum cleaners (which are specifically designed to hold the very small asbestos fibers) are available.

C. Maintenance workers should be protected with filter respirators and protective clothing as necessary.

D. Once a sealant material has been used, repair activities should be strictly controlled as specified in 4A and 4C above.

6. Where plastic sheets have been used as an interim solution, utmost care should be taken while removal. Removal of the sheets should be handled in the same manner as removing the asbestos containing coating (see section 8 below).

7. Installment of drop-ceiling below the asbestos-containing ceiling is not an acceptable solution since it does not seal effectively the asbestos fibers.

It should also be emphasized that latex paint as a sealant does not meet most of the criteria for a sealant, listed in 3C above.

8. Where the removal of the asbestos-containing sprayed-on surface material is warranted, it is important to note the following: Removal of asbestos material must be carried out according to the procedures outlined in the attached bulletin (Appendix B). To insure the safe removal and disposal of the asbestos material, this work should be done only by qualified asbestos workers and contractors. Removal of the asbestos material without following the proper procedures may make the problem worse!

It is suggested that the removal procedure outlined below should be included in the specifications of the removal contract. Alternatively, the contractor should guarantee in writing that the regulations regarding asbestos materials removal and disposal, as specificed by OSHA (Federal Rules: 28 CFR 1910.1001) and EPA (40 CFR 61.22), will be followed.

APPENDIX A

LABORATORY FACILITIES

The following companies have indicated that they are capable of conducting asbestos analysis. Companies and/or contractors on these lists should not be construed to be an endorsement by this Department. Testing firms are included merely on the basis of an affirmative response to telephone inquiries which asked whether or not the companies were capable of:

1. asbestos determination analysis

2. percent asbestos by dry weight in a given sample

All those listed have requested that the sample be placed into a "zip-lock" plastic bag and mailed to their address in a cardboard tube. (Telephone contact should be made before sending samples to determine other sampling requirements.)

1.) Betz Environmental Engineering, Inc.
1 Plymouth Meeting Mall
Plymouth Meeting, Pennsylvania 19462
Attention: Mr. Ronald Neu

Telephone Number: 215-825-3800 Extension 372
Analysis turnaround time - 10 to 20 days

2.) Clayton Environmental Consultants
25711 Southfield Road
Southfield, Michigan 48075
Attention: Mr. Robert Soule

Telephone Number: 313-424-8860
Analysis turnaround time - 5 to 10 days

3.) Haller Testing Laboratories Inc.
336 Leland Avenue
P.O. Box 46
Plainfield, New Jersey 07061

Telephone Number: 201-756-4637

4.) John H. Banks Laboratories Inc.
49 Cannonball Road
Pompton Lakes, New Jersey 07442
Attention: Dave Miller

Telephone Number: 201-839-3450
Analysis turnaround time - 24 to 48 hours

5.) McCrone Associates
2820 South Michigan Avenue
Chicago, Illinois 60616

Telephone Number: 312-842-7100
Analysis turnaround time - 10 to 15 days
Rocommend sending sample by UPS or Air Freight Carrier

6.) Rossnagel and Associates
1999 Route 70
Cherry Hill, New Jersey 08003
Attention: Salenn Choudhary

Telephone Number: 609-424-4440
Analysis turnaround time - 3 to 5 days

7.) Structure Probe, Inc.
(a) P.O. Box 342
Westchester, Pennsylvania 19380
Attention: Thomas Nightingale
Telephone Number: 215-436-5400

(b) 230 Forest Street
Metuchen, New Jersey 08840
Telephone Number: 201-549-9350

Analysis turnaround time - 3 to 5 days

8.) U. S. Testing Company, Inc.
1415 Park Avenue
Hoboken, New Jersey 07030
Attention: Mr. D. Hansen

Telephone Number: 201-792-2400

9.) William R. Bradley and Associates
87 Homestead Road
Tenafly, New Jersey 07670

Telephone Number: 201-567-7929
Analysis turnaround time - 2 weeks

10.) Recon Systems, Inc.
Cherry Valley Road
Princeton, New Jersey 08540
Attention: Mr. R. M. Wolfertz

Telephone Number: 609-921-2112
Analysis turnaround time - 14 days

11.) Princeton Testing Laboratory
Princeton Service Center
U.S. Route 1
Princeton, New Jersey 08540
Attention: Mr. W. Pickup

Telephone Number: 609-452-9050
Analysis turnaround time - 10 to 14 days

12.) Craig Testing Laboratories, Inc.
565 E. Harding Highway
Mays Landing, New Jersey 08330
Attention: Mr. F. Craig, Jr.

Telephone Number: 609-625-1725
Analysis turnaround time - 1 to 5 days

APPENDIX B

REMOVAL PROCEDURE FOR SPRAY-ON ASBESTOS CONTAINING MATERIAL

The following removal procedure has been formulated after review of applicable federal regulations (40 CFR 61.20-61.24). Any person responsible for a renovation operation involving the removal of asbestos-bearing material is hereby advised to review said regulations in order to insure compliance therewith.

1. The removal area should be sealed off in total or in working sections, closed doors should be double sealed with tape and plastic, large areas such as hallways should be sealed by hanging plastic or vinyl tarps and sealing with tape.

2. Just prior to actual removal, spray the asbestos containing material with the following mixture of water and surficant until saturated.

1 fluid ounce of surficant to 5 gallons water

Surficant: 50% polyoxyethylene Ester
50% polyoxyethylene Ether

3. The asbestos containing material and/or substrate (plaster board) is manually removed and placed in a sealable type container for transport to a sanitary landfill. Closable type dumpsters may be used as long as the asbestos containing material is completely wet.

4. All walls and floors in the removal area are then steam cleaned and/or vacuumed to remove any remaining residue. The vacuum cleaners must be designed to cope with the very small asbestos fibers (special filters must be used).

5. All wastes including sealing tape, plastic tarps, vacuum wastes, and workmens clothing are to be deposited in the sealable container, sealed, and disposed of along with the asbestos containing material in sanitary landfill and immediately covered with fill dirt.

The Solid Waste Management Administration, Chemical and Hazardous Materials Section must be notified (609-292-7645) prior to disposal in a New Jersey landfill. Information on available landfills can also be obtained from the Solid Waste Management Administration at the same number.

6. Workers involved in asbestos removal should be equipped with:

a. OSHA approved mask respirator.

b. Disposable clothing, including gloves and foot covering.

In additon, the workers must remove the disposable clothing prior to leaving the site and it is strongly recommended that they be advised to shower prior to eating.

7. The removal of sprayed asbestos containing materials from such structural members as ceiling and/or walls is considered a renovation by the U.S. Environmental Protection Agency (National Emission Standards for Hazardous Air Pollutants Section 61.22(d)(2)) and as such a report must be sent in duplicate for each site location addressed to:

U.S. Environmental Protection Agency, Region II
Director, Enforcement Division
Attention: Marcus Kantz
Room 802, Federal Office Building
26 Federal Plaza
New York, New York 10007

This report must be sent at least 10 days prior to the commencement of removal, and in accordance with 40 CFR 61.22(d)(2) must contain the following information:

a. Name of owner or operator.

b. Address of owner or operator.

c. Description of the building, structure, facility, or installation to be demolished or renovated, including the size, age, and prior use of the structure, and the approximate amount of friable asbestos material used for insulation and fireproofing.

d. Address or location of the building, structure, facility, or installation.

e. Scheduled starting and completion dates of demolition or renovation.

f. Nature of planned demolition or renovation and method(s) to be employed.

g. Procedures to be employed to assure no visible emission of asbestos containing waste materials during the disposal operation.

h. The name and address or location of the waste disposal site where the friable asbestos waste will be deposited.

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DAVID J. BARDIN, COMMISSIONER
P. O. BOX 1390
TRENTON, N. J. 08625
609-292-2885

A Literature Survey of the Hazards and Risks Associated With Exposure to Asbestos

Prepared by

Peter W. Preuss, Ph.D.
Michael Graber, Ph.D.

January 27, 1977

Executive Summary

Properties and Uses

1. Asbestos is the term used to describe naturally occurring minerals that are fibrous, hydrated metal silicates.

2. The asbestos types most widely used commercially are chrysotile, or white asbestos, accounting for 90 to 95 percent of asbestos consumption; crocidolite, or blue asbestos; and amosite, or brown asbestos.

3. Present total apparent consumption (imports less exports) in the United States is close to 1 million tons. About 10 percent is mined domestically in Vermont, California, Arizona and North Carolina.

4. Major uses of asbestos fibers are as a filler substance in the production of various cement products, floor and ceiling tiles, paints, roof-coatings, caulks, plastics, sprayed-on insulation for fireproofing heat and acoustic purposes. Asbestos is also used in the production of asbestos paper, asbestos textiles and some specialized filter media.

5. Current federal regulations and standards which pertain to asbestos are: the Environmental Protection Agency standard (40, CFR 61.20-61.25); the Occupational Safety and Health Administration standard (40, CFR 1910.1001); and the Food and Drug Administration regulation (40, Federal Register 11865, March 14, 1975).

6. EPA emission standard (40, CFR 61.22(e)) states that sprayed-on material used to insulate or fireproof building structures, pipes and conduits shall contain less than one percent on a dry weight basis. In effect, this prohibits the use of such material for these purposes.

7. New York, Illinois and Minnesota have banned coating by spraying of _any_ asbestos-containing material. New Jersey has proposed a similar regulation.

8. The only ambient asbestos standard in the United States (other than those applying to an occupational environment) was issued by the State of New Mexico. An ambient asbestos standard was proposed in 1973 by the State of Connecticut but has not yet been promulgated.

Health Effects, General

The evidence summarized demonstrates that:

Health Effects, General (Cont'd)

1. Asbestos is a human carcinogen.

2. Exposure to all forms of asbestos (blue, white and brown) has been demonstrated to increase the risk of lung cancer and mesothelioma in humans. This risk increase has also been demonstrated in animal studies. The National Academy of Science has concluded that the different types of asbestos cannot be graded as to relative risk with respect to either asbestosis or neoplasia.

3. Exposure to asbestos has been demonstrated to increase the risk of lung cancer and mesothelioma. Other cancers, such as gastrointestinal cancer and laryngeal cancer, have also been connected to asbestos exposure.

4. There is substantive evidence that the risk of cancer is not confined to direct or indirect occupational exposure. People living in the neighborhood of asbestos industries, people working in other industrial settings with low asbestos exposure, and even families of asbestos workers have been shown to be at an increased risk.

5. Low levels of asbestos exposure may also pose a serious threat to the general public, according to the Chief of the Epidemiology Branch of the National Cancer Institute.

6. The data available indicate that a definite risk exists at low levels of exposure to asbestos. This risk is compounded by the exposure to other carcinogens or to cofactors such as cigarette smoke. Persons who smoke cigarettes and are exposed to asbestos have a risk of lung cancer 92 times higher than people who do not smoke and are not exposed to asbestos.

7. Recent studies have indicated that the incidence of mesotheliomas among the non-occupationally-exposed population of Connecticut may have increased by a factor of 10 during the past 40 years. This rise parallels the rate of increase of asbestos usage in that state.

8. Susceptibility to carcinogens seems to vary from one individual to another. At a given exposure level, some persons will develop adverse effects quickly, some after many years, and some never. In the case of low exposure to asbestos, it is possible that a reaction might not appear for 20 years or more.

9. Because of the variability of individual response to carcinogens and other factors, the concept of a "no effect" or "threshold level" may have little real significance on the basis of existing knowledge.

Hazards and Risks; Asbestos Ceiling Coatings

1. Three ways in which exposure to asbestos can occur in cases in which an asbestos-containing material has been sprayed on a ceiling are: persistent low-level fallout from the ceiling; occasional high-intensity loss by direct contact; and repeated re-entrainment and dispersal from floors, desks, etc.

2. The highest exposures and the greatest risks would occur in situations where all three of the above types of exposure were applicable.

3. In the Howell Township schools, all three forms of exposure were present, and therefore posed an increased risk of cancer to both children and employees.

4. It has been suggested in the scientific literature that short-term peak exposures may be as significant as lower exposures over the long-term.

5. In the Howell Township schools, the exposure of both children and employees was of longer duration than that which has been demonstrated to increase the risk of cancer in other groups.

6. As with other substances, a standard which is applicable to the weaker and potentially more susceptible people in society, such as children, should be much lower than the occupational standard set for healthy adults in the workplace.

Chemistry and Physical Effects

Asbestos is the term used to describe naturally occurring minerals that are fibrous, hydrated metal silicates. The asbestos types best known and most widely used commercially include the fibrous form of serpentine known as chrysotile (or white asbestos) and five minerals of the amphibole group: crocidolite (or blue asbestos), anthophylite, actinolite, tremolite and amosite (or brown asbestos).

These asbestos types have different physical and chemical properties, such as chemical composition, crystaline structure, fiber size and thermal and acid behavior. The specific properties of a given asbestos sample are determined by its geographical origin (reflecting the geographical, petrographic, and mineralogical conditions that prevailed during the formation period of the mineral), and to some extent, by the way the mineral was processed. (See Resource 1.)

Chrysotile (which accounts for 90 to 95 percent of world asbestos consumption) possesses good heat resistance but is destroyed by acids. Crocidolite and amosite, the other important forms of asbestos, are characterized by good resistance to heat as well as to acids and other chemicals. Anthophylite, actinolite and tremolite are used infrequently.

The total apparent consumption of asbestos in the United States in 1974 (i.e., total quantities produced locally and imported, less quantities exported) was reported to be 817,100 tons (CEH, 1975).[1] The average apparent consumption for the last ten years is 791,100 tons. Although asbestos is mined domestically in four states (chrysotile in Vermont, Arizona and California; anthophilite in North Carolina), approximately 90 percent of the asbestos used here is imported.

Asbestos has been estimated to have over 3,000 uses (Kover, 1976). Major use categories (based on the amount of asbestos used) include:

1. asbestos cement products
2. floor tiles
3. asbestos paper
4. friction material and gaskets
5. paints, roof coatings, caulks, etc.
6. asbestos textiles
7. plastics

Significant minor uses include:

1. sprayed insulation for fireproofing
2. molded thermal insulation
3. filter media

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[1] For full bibliographical information on all citations in this paper, see the bibliography at the end of the report.

When discussing possible health hazards associated with exposure to asbestos, a distinction must be made between uses where the asbestos fibers are firmly bonded into the products (such as floor tiles and asbestos cement), and uses where the asbestos-containing material is friable, or in powder form (such as sprayed-on insulation). It has been estimated that about 15 percent of the asbestos currently consumed is used in a form where the fibers are not tightly bonded and are, therefore, able to become airborne to a certain degree under certain circumstances (Tabershaw, 1968).

Detrimental health effects may result from exposure to asbestos fibers found in:

1. Emissions from industrial processes involving the use or manufacture of asbestos products -- especially from such emission sources which are poorly controlled at present.
2. Emissions from construction and demolition (conventional and explosive demolition of buildings containing asbestos-bearing material).
3. Emissions from vehicle brake linings.
4. Emissions from deteriorating sprayed-on, asbestos- containing materials used for insulation (thermal or accoustical), fireproofing or for decorative purposes.

Asbestos dust created by the wear of vehicle brake linings (which are about 50 percent asbestos by weight) and dispersed from the brakes into the open air might be the cause for elevated asbestos levels observed at toll booth areas. However, more definitive work is needed to establish the actual quantity released from this source (Nicholson & Pundsack, 1973).

Asbestos from brake linings is considered by the National Institute of Occupational Safety and Health (NIOSH) to be an occupational hazard to workers who perform the periodic servicing of vehicle brakes and clutches (see Resource 2). This source is not controlled at this stage.

Sprayed-on asbestos-containing materials for fireproofing purposes are very widespread. Current Environmental Protection Agency (EPA) regulations limit the use of fireproofing and acoustic materials to those that contain less than one percent by weight of asbestos (see Resource 3). These regulations have the effect of prohibiting use of asbestos-containing materials for such purposes. Older buildings may contain sprayed-on materials in which the asbestos content is much higher (from five percent up). A recent report (Nicholson, Rohl and Weisman, 1976) indicates that the asbestos levels inside buildings where sprayed-on, asbestos-containing fireproofing material was used are considerably higher than in the ambient outdoor air. The reason for these higher interior levels of asbestos is the circulation by the central supply system of air contaminated by contact with sprayed material.

Health Hazards and Risks

Asbestosis

Asbestosis, or asbestosic pneumoconiosis, was the first clearly demonstrated adverse health effect caused by human contact with asbestos.

Pulmonary asbestosis is a slowly progressive, non-malignant disease which may not be detectable by chest X-ray in the early stages, but which is generally characterized by X-ray patterns showing diffuse interstitial fibrosis (increased fibrous tissue growth) in the lungs. The main symptom is dyspnea, or undue shortness of breath. The disease is progressive because, even in the absence of further exposure, those inhaled fibers which have been trapped within the lung continue their biological action. In its severe forms, death results from inability of the body to obtain requisite oxygen or from the heart's failure to pump blood through the scarred lungs (Fed. Reg. 1975a, Resource 4; Castelmen, 1973).

Asbestosis usually develops after long exposure to high concentrations of asbestos dust. Thus, it is largely confined to occupational exposures. The degree of risk varies directly with the length of exposure and the concentration.

All varieties of asbestos can produce asbestosis. It is not known whether one type of asbestos is more fibrogenic than another (Kover, 1976). The first published mention of a case (Murray, 1907), pertains to a man who had worked for 10 years in the carding room of an asbestos factory. Results of an autopsy showed that his lungs had been severely scarred and contained numerous fibers identified as asbestos.

Cooke reported a second case in 1924 (Cooke, 1924) and in 1927 provided a more detailed description in which the term "asbestosis" was first used (Cooke, 1927).

In 1930, (Merewether, 1930) a review of the salient features of the disease led to the promulgation of regulations for environmental and medical control in the United Kingdom. These regulations became effective in 1932 (Asbestos Industry Regulation, 1931).

Cases were first reported in the United States in 1930 (Mills, 1930; Soper, 1930) and guidelines for acceptable dust concentrations were proposed by Dreesen et al in 1938 (Public Health Bulletin 241; National Academy of Science, 1971).

Cancer

In time, the scope of medical concern with the diseases resulting from asbestos exposure expanded. In 1935, 50 years after the first use of asbestos, a relationship with lung cancer was reported (Lynch, 1935). Despite other isolated reports, an association was not firmly supported by epidemiologic evidence until 1947, when Merewether, Chief Inspector of Factories in the United Kingdom, reported

31 instances of cancer of the lung in 235 persons known by his department to have died with asbestosis between 1924 and 1946 (Merewether, 1947). These numbers for asbestos workers constitute a cancer incidence of 13.2 percent compared to a cancer incidence of 1.31 percent (91/6884) in persons certified as having died of silicosis (a lung disease caused by inhaling silicon) during the same period.

Epidemiological evidence causally relating lung cancer to asbestos exposure came in 1955. Doll, after analyzing the cause of death among 105 men who had worked for at least 20 years in dusty textile plants using asbestos, concluded that the 18 cases of lung cancer that occurred indicated a risk about 10 times that in the general male population (Doll, 1955; NAS, 1971, Resource 5; IARC, 1973, Resource 6). Since that first study, many reports have confirmed an association between occupational exposure to asbestos and a higher than expected incidence of lung cancer.

It has been suggested that the type of asbestos, fiber size, substances absorbed onto or into the asbestos fiber, and other cofactors may play an important role in the effects produced by exposure to asbestos.

Little exists in the form of epidemiological studies based on people who have been exposed to only a single asbestos fiber types. In 1971, the National Academy of Science concluded that

> "Although some in vitro and laboratory studies yield different responses to different types of asbestos, the results do not justify drawing firm conclusions as to the relative pathogenicity of the different types. Nor do epidemiologic studies conclusively support such differences. All epidemiologic studies that appear to indicate differences in pathogenicity among types of asbestos are flawed by their lack of quantitative data on cumulative exposures, fiber characteristics and the presence of cofactors. The different types, therefore, cannot be graded as to relative risk with respect to either asbestosis or neoplosia". (NAS, 1971, Resource 5.)

Experiments with test animals have shown that all commercial types of asbestos (white, blue and brown) are carcinogenic, and can produce both lung tumors and mesotheliomas, (Wagner, 1973; Wagner, 1974; Gross, 1967).

Fiber size and shape are extremely important in determining respirability, deposition, retention, and clearance from the pulmonary tract, and are probably important in determining the site and nature of biologic action. Little is known about the movements of fibers within the human body. The aerodynamic properties of fibers depend largely on their diameter; fibers below

3.5 micrometers (microns) in diameter are regarded as being in the respirable range (NAS, 1971). Asbestos fibers found in sections of lung tissue are usually less than 3 microns in diameter and less than 100 microns in length (IARC, 1973, See Resource 6). Thicker or longer fibers are either not inhaled or are rapidly cleared from the respiratory tract. On a weight basis, only a very small proportion of inhaled fibers are retained. (Timbrell, 1972).

In 1960, 33 cases of pleural mesothelioma (a cancer of the chest lining) were reported in an asbestos mining area of South Africa. These tumors occurred among men working in the mines and mill and in the transportation and handling of the fiber, as well as in the non-mining population living in the vicinity (Wagner, 1960). Numerous reports since then have confirmed the findings that mesothelioma is associated with asbestos exposure. One report concerning workers in a British asbestos factory demonstrated that the same type of tumor could be found commonly in the abdomen (peritoneal mesothelioma) as well as in the chest (Enticknap, 1964).

The first definitive epidemiological study of the effect of asbestos was conducted by I.J. Selikoff and his associates in the early 1960s. Instead of relying on autopsy reports, as had been done in earlier studies, these investigators researched a well-defined population, in this case, all members of the International Association of Heat and Frost Insulators and Asbestos workers in the New York and New Jersey metropolitan area. Between 1943 and 1971, they observed in this group an excessively large number of deaths attributed to higher-than-usual incidence of lung cancer, mesothelioma, cancer of the gastro-intestinal tract and asbestosis (Selikoff, 1973; Elmes, 1971). This study and its extension are discussed in detail elsewhere in this report.

It has been suggested that other tumors are also increased in incidence among asbestos workers, particularly cancers of the larynx (Still, 1973; Newhouse, 1973), neoplasms of the oropharynx (Selikoff, 1970) and of the esophagus (Selikoff, 1973). Recently, laryngeal cancer has been associated with asbestos exposure (Morgan, 1976). However, data concerning these neoplasms are less extensive than data for lung cancer, mesothelioma and gastro-intestinal cancer.

The proportion of groups exposed to asbestos who eventually die of asbestos-related cancers is still uncertain due to the very long period for the cancer to develop, the difficulty of identifying population groups exposed prior to 1940,and the compounding effect of cigarette smoking. It is estimated that as high as 40 to 45 percent of all deaths of workers employed in asbestos factory work or using asbestos products may be attributed to some type of cancer. Mesothelioma is estimated to be involved in five to eleven percent of all such deaths (Selikoff, 1973; Hammond, 1965; Newhouse, 1975).

Intensity of Exposure

Although it is widely assumed, probably correctly, that intensity of exposure strongly influences human cancer risk, there are comparatively few data, apart from cases of cigarette smoking and radiation exposures, that support this belief or establish that a linear relationship exists. In large part, this stems from the absence of exposure data during the period when the implicated agent was not suspected of being carcinogenic. In the case of asbestos, the information available shows that there is a very high rate of cancer at high concentrations of asbestos. Other studies have shown that brief, high-level exposure as well as long-term, low-level exposure leads to an increased risk of cancer (Selikoff, 1972).

Recent data indicate that workers with short periods of employment in an asbestos plant (less than one month) have an increased risk of lung cancer.

TABLE I

Deaths of lung cancer among workers employed
in an amosite factory starting five years from onset of work
1941-1045 to December 31, 1974. Effect of duration of exposure.

Duration of Employment	No.	Death of Lung Cancer 1946-1974 Expected*	 Observed	 Ratio
<1 month	62	1.34	3	2.24
1 month	92	1.44	5	3.47
2 months	79	1.30	8	6.15
3-5 months	145	2.24	8	3.57
6-11 months	129	1.63	9	5.52
1 year	105	1.53	12	7.84
2 years	77	1.06	13	12.26
3-4 years	51	0.87	9	10.34
5+ years	65	1.04	16	15.36
Total	805	12.45	83	6.67

*Expected deaths are based upon white male age-specific death rate data of the U.S. National Office of Vital Statistics 1949-1972. Rates were extrapolated for 1946-1948 from rates for 1949-1955 and for 1973-1974 from rates for 1968-1972.

(Selikoff, data presented at the "Fourth Symposium on Statistics and the Environment": N.A.S. March 3, 1976).

The Existence of a Latent Period

Table II and III show the changes in causes of death from 1943 to 1974 among a single group of 632 asbestos insulation workers. The distribution of causes of death is very much the same for the period 1963-74 (Table III) as for period 1943-1962 (Table II), but the percentages within each category and the ratios between observed and expected deaths are appreciably altered.

Three factors influenced this change. First, as the individuals aged, the distribution of death by cause would also be expected to change, even in the absence of an occupational disease influence. Second, many of the individuals were still at work in 1963, and continued their employment. This factor might be especially significant with individuals having clinical asbestosis, for whom additional dust exposure would be particularly disadvantageous. Third, more time had passed since the workers were exposed to a cancer-causing dose, so that the likelihood of clinical onset and observation of the malignant disease was increased.

Because the latency period between onset of exposure and evidence of disease varies with the type of tumor which may be caused by occupational asbestos exposure, it is to be expected that there would be differences in incidence of these neoplasms (tumors) during the decade of observation. (See Resource 7.)

TABLE II

Expected and Observed Deaths Among 632 Asbestos Insulation Workers, New York-New Jersey, 20 or More Years After Onset of Work, January 1, 1943 to December 31, 1962

	Expected*	Observed	Ratio
Total deaths, all causes	196.16	253	1.29
Total cancer, all sites	31.44	95	3.02
Lung cancer	6.02	42	6.98
Pleural mesothelioma	+	3	
Peritoneal mesothelioma	+	1	
Cancer of stomach, colon, rectum	9.71	29	2.99
All other cancers	15.71	20	1.27
Asbestosis	+	12	
All Other Causes	164.72	146	

*Nine men died before reaching 20 years from first employment. Expected deaths are based upon white male age-specific death rate data of the U.S. National Office of Vital Statistics from 1949-1962. Rates were extrapolated for 1943-1948 from rates for 1949-1955.

+Rates are not available, but these diseases are rare causes of death in the general population.

TABLE III

Expected and Observed Deaths Among 370 New York-New Jersey Asbestos Insulation Workers, January 1, 1963 to December 31, 1974

	Expected*	Observed	Ratio
Total deaths	109.04	198	1.82
Total cancer, all sites	20.58	105	5.10
Lung cancer	6.18	47	7.61
Pleural mesothelioma	+	7	
Peritoneal mesothelioma	+	21	
Cancer of stomach	1.17	7	5.98
Cancer of colon, rectum	2.75	7	2.55
All other cancers	10.48	16	1.53
Asbestosis	+	25	
All other causes	88.46	68	

*Expected deaths are based upon age-specific white male death rate data of the U.S. National Office of Vital Statistics from 1963 to 1973. Rates were extrapolated for 1973-1974 from rates for 1968-1972.

+U.S. death rates not available, but these diseases are rare causes of death in the general population.

These two tables demonstrate the general rule that cancers associated with exposure to identified environmental agents do not become clinically evident for 20 or more years after first exposure; often the elapsed period is 30, 40 or more years. In a study of 17,800 asbestos insulation workers in the United States and Canada, both total cancer and lung cancer increase were limited until after the 20-year points (Selikoff, 1975). It is likely that this latency period is, in some instances at least, a composite effect and includes both the influence of total accumulated exposure and that of the passage of time from first exposure (or, perhaps more accurately, from the time sufficient exposure has occurred to result in increased cancer risk). Total exposure has clear influence, as observed with uranium mining, aniline bladder cancer and asbestos exposure (Wagoner, 1965; Williams, 1958; Selikoff, 1975).

Cancer latency periods vary because of individual reactions to carcinogens and differences in length and intensity of exposure. For any given exposure dose, some individuals will respond early, some late and some not at all. For each exposure level a different latent period probably exists. These latent periods are probably related to the intensity of exposure.

Interaction of Asbestos Exposure with Cigarette Smoking

Evidence of the carcinogenic potential of asbestos was developed over the period 1935-1965. In 1967, it was discovered that for the most important of these cancers--lung cancer-- the risk did not depend on asbestos alone. Rather, in workers who were exposed to asbestos, but did not smoke cigarettes, the tumor was uncommon (Selikoff, 1968).

A larger study was undertaken to verify this first study. On January 1, 1967, the entire membership of the International Association of Heat and Frost Insulators and Asbestos Workers, AFL-CIO, CLC, were registered for the study and have been observed ever since. When the group was enrolled, each man was asked to record his lifetime smoking habits.

Analysis of lung cancer deaths among the study's 17,800 men, to December 31, 1972, showed that increased risk of lung cancer was limited to asbestos workers who also had a history of cigarette smoking (see Table IV). The report states:

> "These findings again demonstrate that asbestos workers who do not smoke, or smoke only pipe and/or cigars, have about the same lung cancer risk as men not occupationally exposed to asbestos dust. However, exposure to asbestos dust greatly increases the lung cancer risk among cigarette smokers." (Selikoff and Hammond, 1975.)

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TABLE IV

Expected and observed deaths of lung cancer among 17,800 U.S. and Canada asbestos insulation workers, January 1, 1967-December 31, 1972; relation to cigarette smoking

	No. of Persons	Deaths from lung cancer		
		Expected[a]	Observed	Ratio
Smoking habits not known	6,144	16.76	94	5.6
History of cigarette smoking	9,590	31.60	179	5.7
No history of cigarette smoking	2,066	7.51	2	0.3
Never smoked	1,457	4.40	1	0.2
History of pipe and/or cigar only	609	3.11	1	0.3

[a] Expected deaths based upon age-specific U.S. mortality rates for white males, disregarding smoking. Lung cancer estimates based on U.S. rates for cancer of lung, pleura, bronchus, and trachea, categories 162 and 163 of the International Classification of Diseases and Causes of Deaths, 7th Revision.

In 1976, it was shown that laryngeal cancer, a disease previously linked to cigarette smoking, was also associated with asbestos exposure. Thus, it joined lung cancer as a disease of the asbestos worker who smokes. Incidences of other cancers associated with asbestos exposure, such as mesothelioma and gastro-intestinal cancer, do not appear to vary with smoking habits and history (Morgan, 1976).

Indirect Occupational Exposure and Neighborhood Exposure

In 1972, it was reported that 37 cases of mesothelioma had occurred in shipyard workers whose only exposure to asbestos was from proximity to asbestos workers. Thus, indirect occupational exposure was sufficient to produce mesothelioma years later (Harries, 1972). This original finding has been widely confirmed and a number of cases of mesothelioma have since been reported in former shipyard workers. X-ray studies of current shipyard workers have shown asbestos abnormalities among workers in trades only indirectly exposed to asbestos in the yards (40 Fed. Reg. 47656 Oct. 9, 1975. See Resource 4).

Another study showed that gold miners exposed to a relatively low level of asbestos (about one-tenth of the current Occupational Safety and Health Association (OSHA) standard) had three times the expected risk of malignant respiratory disease. Furthermore, in a study of the mortality experience of a large United States asbestos products manufacturing facility, it was found that workers in low-dust areas, with a minimum risk of death from asbestosis, had the same high risk of death from cancers as workers in dustier areas (Nicholson, 1976. See Resource 8).

In 1960, cases of mesothelioma were reported in persons not occupationally exposed to asbestos but living in the vicinity of asbestos mines. Other cases of mesothelioma resulting from neighborhood exposure to asbestos were described in epidemiologic reports from New Jersey and Pennsylvania in 1967. (Wagner, 1960; Borow, 1967; Lieben, 1967.) A report from Germany on 119 cases of pleural mesothelioma considered asbestos emitted into the air from an industrial facility to be a major cause of death in the surrounding area (Dalquen, 1969).

Exposure in the Homes of Asbestos Workers

In 1965, nine cases of mesotheliomas were reported in individuals who lived with asbestos workers and who had no exposure to asbestos at the workplace (Newhouse, 1965). Additional reports from nine countries have brought the total number of reported cases of household mesothelioma to 37. Recently, four additional cases of mesothelioma in family members of former asbestos factory employees were reported. In addition, 35 percent of the 326 family members had chest X-ray abnormalities (Anderson, 1976).

The threat of asbestos brought into the home was well described by Dr. Paul Kotin, medical spokesman and vice-president for the Johns-manville Corporation in a recent statement:

> "I would suggest, however, that once asbestos gets into the home, carried home by the workmen (which in itself is a tragedy; it shouldn't happen) it is asbestos that is there virtually permanently. It gets into the rugs, into the carpets, it gets suspended by movement, and, actually, you are getting 24 hour/day exposure, relatively speaking, rather than a partial exposure. But even worse than that is the fact that you are exposing the population of the family which includes the very young and very old. And in the induction of cancer, it is the very young that are always the most susceptible. We use the fact that it is the young that are the most susceptible in the laboratory when we want to test agents for their ability to induce cancer." (Presentation before OSHA Advisory Committee on Construction Safety and Health, January 22, 1976)

Community Exposure

There is a difference of opinion in the literature about the hazard and risk involved in exposure of the general population to levels of asbestos such as may normally be encountered in the ambient environment. A number of studies have shown that asbestos fibers and "bodies" are present in the lungs of most adults who have lived in urban areas (IARC, 1973). In no analysis of causes of death in a large population has there been quantitative estimation of the lung content of such bodies and bare asbestos fibers, to determine whether a detectable gradient of disease can be correlated with asbestos content.

The more recent literature indicates that a risk does in fact exist, while the literature from the early years of this decade concluded the opposite. The National Academy of Sciences concluded in 1971:

> "The series so far studied have been too small, and the methods too variable, to permit any conclusions as to the importance of small fiber numbers in the lung." (NAS, 1971. See Research 5)

The International Agency for Research on Cancer concluded in 1973:

> "There is no evidence that this lung burden is a cause of excess morbidity or mortality in the general population." (IARC, 1973. See Research 6.)

Furthermore, the report states:

> "At the present time (1972) there is no evidence that exposure of the general population to past levels of asbestos dust in the ambient air or in beverages, drinking-water, food or pharmaceutical preparations increased the risk of cancer." (IARC, 1973.)

This last statement was reproduced in the Draft List of Selected Carcinogens circulated for comment by the Department of Environmental Protection in Nov. 1976. In response, Dr. Irving Selikoff wrote:

> "It is stated that 'at the present time, there is no evidence that exposure of the general population to past levels of asbestos dust in the ambient air or in beverages, drinking water, food or pharmaceutical preparations increased the risk of cancer.' There is no evidence, because the matter has not been studied. There are no data one way or the other. The statement as it stands is misleading since it suggests that investigation has provided 'no evidence that.'" (Personal communication, I. Selikoff to G. Paulson, Nov. 16, 1976, see Research 9.)

In a more recent review, Dr. J. Fraumeni, Chief of the Epidemiology Branch of the National Cancer Institute, said:

> "Low asbestos exposures may also pose a serious threat to the general public; asbestos bodies and calcified pleural plaques are present in large segments of the population, and high ferruginous body (fibers coated with an iron-containing material in the lung) were found in a recent study of lung cancer patients without known occupational exposure to asbestos." (Fraumeni, 1975.)

The question of a possible "safe" level has also been addressed by the U.S. Department of Labor in October, 1975: (See Resource 4.)

> "Cancer development may be influenced by such factors as the differing susceptibility of various body organs. Because of the variability of individual response to carcinogens and other factors, the concept of a 'no effect' or 'threshold level' may have little real significance on the basis of existing knowledge.

> "While some level, below which exposure to a carcinogen does not cause cancer, may conceivably exist for any one individual, other individuals in the population may have cancer induced by doses so low as to be effectively zero. This is not to say that researchers will never find a threshold level for a carcinogenic substance, but it does mean that the threshold concept for carcinogens is, at present, more a matter of responsible regulatory policy than a precise, scientific determination.
>
> "These theoretical concepts have a bearing on the asbestos issue, particularly as to the question of the existence or nonexistence of a threshold level of carcinogenic effect. A 'no effect' level theoretically may exist, but it has not been demonstrated." (40, Fed.Reg. 47651, Oct. 9, 1975).

At the present time, in spite of considerable research on the effects of carcinogenic substances, no data exist that would define a threshold for any carcinogen (Nicholson, 1976. See Resource 8).

> "The task confronting one who would define a level below which no carcinogenic risk exists for human populations is virtually an impossible one. This is especially true for asbestos. Serious human disease can readily be seen in studies of occupational groups exposed at high concentrations, although the levels of exposure be only crudely defined. At lower exposures, however, three unfulfilled requirements confront the investigator attempting to establish a 'no effect' level for asbestos.
>
> 1. a sufficiently large population for observation;
> 2. knowledge of the asbestos concentrations to which the population was exposed; and
> 3. an observation time sufficient for the effects of asbestos to be manifest."

One study, in which some of these issues of population study size and latency period are looked at, will be published in February, 1977. Based on the Connecticut Tumor Registry, it will be a study of mesothelioma incidence in the state from 1935 to 1972. During that period, 133 cases of mesothelioma were diagnosed; 89 cases were in men, and 44 in women.

Of particular interest are the following:

- the incidence rate of mesothelioma increased 10-fold between 1935 and 1972.
- most of the people had no known direct or indirect occupational exposure to asbestos.
- the incidence rate closely follows the increase in the state's cummulative asbestos consumption.

The authors of the study conclude that a linearly increasing cause-effect relationship is suggested by their data (Bruckman, et al, 1977).

Howell Township Schools and the Yale Art and Architecture Building

Recently, the presence of sprayed-on asbestos material was found in four school buildings in Howell Township, New Jersey (see Resource 14). In these schools, all of similar architecture, the low ceilings of the corridors were treated with asbestos material sprayed on for acoustical and fireproofing purposes. The sprayed-on material had aged and was flaking off the ceiling. In addition, school children scraped off the peeling material. Chemical analysis of the ceiling material revealed that the asbestos content was 25-65 percent (in all four schools chrysotile was present in one case, anthophylite, as well.)

An air sampling test, to discover the amount of asbestos present in the air of the school buildings, was conducted in one of the schools (Ramtown School). The test showed that under quiet conditions (i.e., no human physical activity) the levels of asbestos fiber counts reached 0.06 fibers per cubic centimeter, whereas under disturbed conditions (simulating the various activities of the school children) the levels of fiber counts reached 3.5 fibers per cubic centimeter.

In response to the situation encountered in Howell Township, the Department of Environmental Protection took two steps:

- A guidance document was prepared which explains what action should be taken at other schools facing the same problem (see Resource 15).
- A regulation to control and prohibit sprayed-on asbestos surface coatings was proposed (see Resource 16).

A paper describing in detail the sequence of events at Yale (Sawyer, 1976) is of interest because of the similarity of the description to the situation encountered in the Howell Township schools.

The Yale Art and Architecture Building was completed in 1963. During the final stages of construction, ceiling surfaces in the buildin had been sprayed with a mixture containing asbestos fibers. The mixture had been sprayed to a thickness of between 0.5 and 1.0 inch on suspended gypsum board, and in a few areas directly on concrete. The ceiling material contained chrysotile asbestos, estimated at approximately 25 percent of the total mass. Soon after application, the exposed and friable ceilings began to disintegrate. Air currents, ventilation leaks, humidity changes, and vibration caused fiber loss at a low rate. Also, many of the ceiling surfaces, only 80 inches high in some areas, were easily reached and became easy prey to both accidental and capricious contact.

A theory was developed and tested that fiber contamination occurred in three modes. These modes or rates included persistent low-level fallout from the ceiling (R1), occasional high-intensity loss by direct contact (R2), and repeated reentrainment and dispersal from surfaces such as floors, desks and shelves (R3).

Sampling and analysis of the asbestos fiber count in the air was carried out, using the light microscope procedure. Results are given as the number of asbestos fibers longer than five microns per cubic centimeter of air.

TABLE V

Airborne Asbestos, Yale A&A Building, 1974

Sampling Conditions or Situation	Counts Mean	(Fibers/cc) N *	SD**
City Background			
New Haven	0.00	10	0.00
Building Background			
Fallout (R_1)			
Quiet conditions	0.02	13	0.02
Impact (R_2)			
Cleaning, moving books in stack area	15.54	3	6.74
Relamping light fixtures	1.38	2	0.13
Dispersal (R_3)			
General Activity:			
random areas	0.19	10	0.26
students	0.02	15	0.03
administration	0.04	11	0.04
food service	0.09	4	0.06
library staff	0.32	6	0.33
Custodial service:			
sweeping, dry	1.63	5	0.73
dusting, dry	4.02	6	1.28
proximal to cleaning	0.26	6	0.26

* Number of samples
** Standard deviation

It was concluded that:

> "exposures of occupants to asbestos from the ceilings were measured and found within the range implicated in the development of malignacies." (Sawyer, 1976.)

In 1974, the building was vacated and closed for removal of all ceiling material containing asbestos.

These two instances seem to be very similar. The conditions in the school system, although not monitored as extensively, seem to be of the same order of magnitude as those in the Yale building. The course of action followed in the two cases - wet removal of the ceiling - was also the same.

Monitoring of the air in the Yale building showed that after removal of the asbestos-containing material from the ceilings, and after clean-up, the concentration of asbestos fiber fell to the same level as that of the background fiber count.

Regulations and Standards

Asbestos Emission Standards

The standard adopted by the EPA (40 CFR 61.20 - 61.25. See Appendix 3) limits the emissions of asbestos from specified types of sources and operations (asbestos mills, manufacturing operations, demolition and renovation operations, spraying, fabrication, waste disposal for manufacturing facilities and for asbestos mills). In each case the limitation set is either (1) no visible emission, or (2) use of specified methods to clean emissions containing particulate asbestos material before such emissions escape to, or are vented to, the outside air.

According to EPA, these standards were chosen because at this time it was impractical to establish allowable numerical concentration or mass emission limits for asbestos, since satisfactory means of measuring asbestos emissions are not yet available (see page 27).

The EPA standard refers specifically to the spraying of asbestos-containing materials (40 CFR 61.22):

> "(e) Spraying: There shall be no visible emissions to the outside air from the spray-on application of materials containing more than 1% asbestos, on a dry weight basis, used to insulate or fireproof equipment and machinery except as provided in 8 (f) (use specified cleaning methods of emissions containing asbestos of this section). Spray-on material used to insulate or fireproof buildings, structures, pipes and conduits, shall contain less than 1% asbestos on a dry weight basis."

The EPA standard includes all types of asbestos (white, blue and brown) in its definition of what is to be controlled. The EPA approach has been adopted as a state law by a number of states with little or no change (Colorado: Environmental Reporter 326:0710; Kentucky: Environmental Reporter 386:0513; Wisconsin: Environmental Reporter 551:0557).

Three states have banned the spraying of asbestos-containing material:

1. New York - prohibition 221.2 (Environmental Reporter 366:0662): "No person shall engage in or allow surface coating by spraying of asbestos or asbestos-containing material."

2. Illinois - Rule 631 (Environmental Reporter 366:9701): "The spraying of asbestos-containing material is prohibited after March 31, 1971."

3. Minnesota - (Environmental Reporter 416:0801): (aa) The spraying on any portion of a building or structure of any accoustical insulating, thermal insulating or fireproofing product which contains asbestos is prohibited.

"(bb) The spraying in any area open to the outdoor atmosphere of accoustical insulating, thermal insulating, or fireproofing product which contains asbestos is prohibited."

Asbestos Occupational Hazard Standards

The U.S. Occupational Safety and Health Administration (OSHA) has issued an occupational hazard standard which, effective July, 1976, is: (29, CFR 1910.1001. See Resource 11)

"(2) The eight-hour time-weighted average airborne concentrations of asbestos fibers to which any employee may be exposed shall not exceed two fibers, longer than 5 micrometers per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section.

"(3) Ceiling Concentration - No employee shall be exposed, at any time, to airborne concentrations of asbestos fibers in excess of ten fibers, longer than 5 micrometers, per cubic centimeter of air, as determined by the method prescribed in paragraph (e) of this section."

The OSHA standard also specifies the types of approved respirators to be used by workers exposed to asbestos, the requirements for special clothing, changing rooms, laundering, caution signs and labels, cleaning and waste disposal, and medical recordkeeping, as well as the method to be used for the sampling and analysis of the asbestos fibers in the air.

In October, 1975, a further reduction in this standard was proposed by OSHA, from 2 fibers/ml to 0.15 fibers/ml. At that time, OSHA's position was that "prudent policy would therefore seem to indicate that every reasonable measure should be taken to eliminate human exposure to chemical compounds as soon as their carcinogenic nature is identified." (40, Fed. Reg. 47651, Oct. 9, 1975. See Resource 4.) Since that time, NIOSH has suggested that the standard be lowered even further to 0.1 fiber/cc.

Even at the lower level suggested by NIOSH, there are problems regarding the standard which result from inadequacies in the technique used for measuring the concentration of asbestos fibers in the air. The OSHA Occupational Hazard Standard is unsatisfactory because:

1. The standard specifies a measurement technique which counts asbestos fibers longer than 5 micrometers only. As a result, information about the smaller fibers is lost.

2. The measurement technique is based on fiber counting with the aid of optical microscopy. There is an inherent unknown error in this method of measurement which is caused by two factors:

a. The ability of the person performing the count to correctly identify asbestos fibers relative to other fibers present.

b. The variable distribution of the fibers over the sampling filter. Since only small portions of the filter are analyzed, incorrect selection of those portions may result in erroneous results.

Many scientists studying the exposure of the general public to asbestos (e.g., Bruckmann, 1975; Nicholson and Pundsack, 1973) prefer to express ambient levels in units of asbestos weight per unit volume of air (i.e., nanograms of asbestos per cubic meter of air). This approach is, in principle, simpler and more objective than fiber counts, since it involves only mass measurement and air flow rate. There are, however, several problems involved with this type of measurement as well (Nicholson and Pundsack, 1973):

1. No information is obtained regarding the size of the asbestos fibers, nor about the size distribution.

2. No standardized technique to determine the weight of the asbestos sample exists. The various methods currently in use are summarized in Resource 12.

Finally, no satisfactory method exists for comparing results obtained by one method of measurement with those obtained by another. Methods which have been suggested can give results that vary by many orders of magnitude. Therefore, most monitoring results are evaluated against other samples measured similarly but taken from areas considered to represent "background".

U.S. Food and Drug Administration

The U.S. Food and Drug Administration regulations limit the amount of asbestos that food, drug and cosmetic products may contain. In some cases, the standard limits the use of asbestos filters for preparation of these products (40, Federal Register, 11865, March 14, 1975).

State Ambient Air Standards

New Mexico is the only state which has promulgated an ambient air quality standard for asbestos (Environmental Reporter 456:0503):

Section 201: "When one or more of the following elements are present in the total suspended particulate, the maximum allowable concentrations of the elements involved, based on a 30-day average, are as follows:

1.	beryllium	0.01 ug/m^3
2.	asbestos	0.01 ug/m^3
3.	heavy metals (total combined)	10 ug/m^3

The New Mexico asbestos air quality standard of 0.01 ug/m^3 is equivalent to 10 ng/m^3.

The State of Connecticut has proposed an ambient air quality standard of 30 ng/m^3.

Cases of Asbestos Exposures not Covered by Current Laws

The following cases, which are not covered by current laws and regulations related to the exposure to asbestos-containing materials, have been reported:

1. Spray-on application of decorative materials containing asbestos. This problem formed the basis for Governor Byrne's petition to the EPA Administrator to amend the federal rule on asbestos spraying.

2. Application of asbestos-containing sealant and patching substances. The problem has been discussed in detail in a petition by the National Resources Defense Council before the United States Consumer Protection Safety Commission, which seeks to ban certain patching compounds that they consider to constitute hazardous materials (see Resource 17).

3. Asbestos contamination of building air supply systems. Measurements carried out in buildings where the air supply comes into contact with asbestos-containing insulation and fireproofing, have shown increased levels of asbestos in the air (Nicholson Rohl and Weisman, 1976).

4. Asbestos dust from the wear of asbestos-containing brake linings in cars. This dust is dispersed from the brakes (about 50 percent asbestos by weight into the open air. More definitive work needs to be done to establish the actual quantity released from this source. Nicholson and Pundack, 1973.)

5. Asbestos-containing material sprayed on for ceiling insulation and fireproofing purposes in previous years, and in which the asbestos containing-material is decomposing and becoming friable with age. This problem has been summarized in Governor Byrne's letter to the EPA administrator, dated January 7, 1977 (see Resource 14).

6. Motor vehicle brake and clutch servicing. In this case, the asbestos-containing lining of the automobile brakes wears down, and accumulates inside the brake drums in the form of dust. Garage workers who perform the periodic servicing of vehicle brakes are thus potentially exposed to high levels of asbestos-containing dust. NIOSH, considering this to be an occupational hazard, has recommended that the OSHA standard be amended to include procedures for asbestos brake and clutch servicing (see memorandum August 8, 1975 by J.W. Lloyd, Director, Office of Occupational Health Surveillance and Biometrics).

7. Talc contaminated with asbestos--The U.S. Food and Drug Administration has decided not to promulgate any final regulation for the contamination of talc by asbestos particles until a standard method of analysis is developed for this substance (40, Federal Register 11865, March 14, 1975 and Langer, 1974).

Bibliography

1. Anderson, H.A. et al., 1976: Household-contact Asbestos Neoplastic Risk. In: Occupational Carcinogenesis (U.Saffiotti and J.K. Wagoner eds.), Ann. N.Y.A.S., 271:311.
2. Asbestos Industry Regulations, 1931: Statutory Rules and Orders 1931, No. 1140, London, H.M. Stationary Office.
3. Borrow, M. et al., 1967: Mesothelioma and its association with Asbestos, J.A.M.A., 201:587.
4. Bruckman, L. and R.A. Rubino, 1975: Asbestos: Rationale behind a proposed air quality standard, J.A.P.C.A., 25:1207.
5. Bruckman, L. Et al., 1977: Asbestos and mesothelioma incidence in Connecticut, J.A.P.C.A., in press.
6. Castleman, B.I. and A.J. Fritsch, 1973: Asbestos and You, Center for the Science in the Public Interest, Washington, D.C.
7. CEH, 1975: Chemical Economic Handbook, Stanford Research Institute, Menlo Park, Calif.
8. Cooke, W.E., 1924: Fibrosis of the lung due to the inhalation of Asbestos dust, Brit. Med. J., 2:147.
9. Cooke, W.E., 1927: Pulmonary asbestosis, Brit. Med. J., 2:1024.
10. Dalquen, P. et al., 1969: Epidemiologie der Pleuramesothelioma Vorlaufiger Bericht ueber 119 Faelle aus dem Hamburger Raum, Prax. Preumol, 23:547.
11. Doll, R., 1955: Mortality from lung cancer in asbestos workers, Brit. J. Ind. Med., 12:81.
12. Dressen, W.C. et al., 1938: A study of Asbestos in the Asbestos Textile Industry, Public Health Publication No. 241, Washington D.C., U.S. Government Printing Office.
13. Elmes, P.C., and M.J. Simpson 1971: Industrial workers in Belfast. III, Mortality 1940-1946, Brit. J. Ind. Med., 28:226.
14. Enticknup, J.B. and W.N. Smither, 1964: Peritioneal tumours in asbestosis, Brit. J. Ind. Med., 21:20.
15. Fed. Reg., 1975a: Occupational exposure to Asbestos-Notice of proposed rulemaking, Occupational Safety and Health Administration, U.S. Department of Labor, Federal Register, 40, October 9, 1975: 47651 (see Resource 4).

16. Fed. Reg., 1975 b: Asbestos-form particles in drugs for parenteral injection, Food and Drug Administration, U.S. Department of Health, Education and Welfare, Federal Register, 40, March 14, 1975: 11865. (See Resource 13)

17. Fraumeni, J.F., 1975 Respiratory carcinogenesis: An epidemiological appraisal, J. Nat. Cancer Inst., 55:1039.

18. Gross, P.T. et al., 1967: Experimental Asbestosis: The development of lung cancer in rats with pulmonary deposits of chrysotile Asbestos dust, Arch. Env. Health, 15:343.

19. Hammond, E.C. et al., 1965: Neoplasia among insulation workers in the U.S. with special reference to intra abdominal neoplasia. In: Ann. N.Y.A.S., 132:513.

20. Harries, P.G., 1972: Brit. J. Ind. Med., 29:274.

21. IARC, 1973: Evaluation of the Carcinogenic Risk of Chemicals to Man: Some inorganic and organometallic compounds, Vol. II, International Agency for Research on Cancer, World Health Organization, Lyon: 17-47.

22. Kover, F.D., 1976: Asbestos: A review of selected literature through 1973 Relating to Environmental Exposure and Health Effects, Office of Toxic Substances, Environmental Protection Agency, Washington, D.C., EPA-560/2-76-001.

23. Lieben, J. and H. Pistawka, 1967: Mesothelioma and Asbestos Exposure, Arch. Env. Health, 14:559.

24. Lynch, K.M. and W.A. Smith, 1935: Pulmonary Asbestosis. III. Carcinoma of lung in asbesto-silicosis, Amer. J. Cancer, 24:56.

25. Mills, R.G., 1930: Pulmonary asbestosis: Report of a case, Minn. Med., 13:495.

26. Merewether, E.R., 1930: The occurrence of pulmonary fibrosis and other pulmonary affections in asbestos workers, J. Ind. Hyg., 12:198.

27. Merewether, E.R., 1949: Asbestosis and carcinoma of the lung. In: Annual Report of the Chief Inspector of Factories for the year 1947, London, H.M. Stationery Office

28. Morgan, R.W. and P.T. Shettigara, 1976: Occupational Asbestos Exposure, Smoking and Laryngeal Carcinoma. In: Occupational Carcinogenesis (U. Saffiotti and J.K. Wagoner eds.), Ann. N.Y.A.S., 271:308.

29. Murray, H.M., 1907: Statement before the committee in the Minutes of Evidence. In: Report of the Department Committee on Compensation for Industrial Diseases, London, H.M. Stationery Office: 121-128.

30. NAS, 1971: Asbestos: The Need for and Feasibility of Air Pollution Controls, The Committee on Biological Effects of Atmospheric Pollutants, National Research Council, National Academy of Sciences, Washington, D.C.

31. Newhouse, M.L. and HA Thompson, 1965: Epidemiology of Mesothelioma Tumors in the London Area, Brit. J. Ind. Med., 22:261.

32. Newhouse, M.L. and G. Berry, 1973: Asbestos and Laryngeal Cancer, A Letter to the Editor, Lancet, 2:615.

33. Newhouse, M.L. and G. Berry, 1975: The risk of developing mesothelioma tumors among workers in an Asbestos textile factory. In: 18th International Congress on Occupational Health, Bristol.

34. Nicholson, W.J., 1976: Case Study I: Asbestos - The TLV Approach. In: Occupational Carcinogenesis (U. Saffiotti and J.K. Wagoner eds.), Ann. N.Y.A.S., 271:152 (see Appendix 8).

35. Nicholson, W.J. and F.L. Pundsack, 1973: Asbestos in the environment. In: Biological Effects of Asbestos (P. Bogovski et.al., eds.), IARC publication No. 8, Lyon: 126.

36. Nicholson, W.J., A.N. Rohl and I. Weisman, 1976: Asbestos Contamination of Building Air Supply Systems, The Institute of Electrical and Electronics Engineers Inc., Ann. No. 75CH1004-I29-6.

37. Sawyer, R.N., 1976: Yale Art and Architecture Building Asbestos Contamination: Past, Present and Future, The Institute of Electrical and Electronics Engineers, Inc., Ann. No. 75 CH1004-I-29-5.

38. Rohl, A.N. and A.M. Langer, 1974: Identification and Quantitation of Asbestos in Talc, Environ. Health Perspective 9:95.

39. Selikoff, I.J., 1976: Lung cancer and mesothelioma during prospective surveillance of 1249 asbestos insulation workers 1963-1974. In: Occupational Carcinogenesis (U. Saffiotti and J.K. Wagoner, eds.), Ann. N.Y.A.S. 271: 448 (see Appendix 7).

40. Selikoff, I.J., 1976a: Data presented at Fourth Symposium on Statistics and the Environment, N.A.S., March 3, 1976.

41. Selikoff, I.J., et al., 1968: Asbestos exposure, smoking and neoplasia, J.A.M.A., 204:106.

42. Selikoff, I.J. and E.C. Hammond, 1970: Asbestos bodies in the N.Y. population in two periods of time. In: Proceedings of International Conference on Pneumoconiosis, Johanesburg, 1969, Oxford University Press: 99.

43. Selikoff, I.J. et al, 1972: Carcinogenicity of amosite asbestos, Arch. Env. Health, 25:185.

44. Selikoff, I.J. et al, 1973: Cancer Risk of Insulation Workers in the U.S. In: Biological Effects of Asbestos (P. Bogovski

et al Eds.), IARC publication No. 8, Lyon: 209.

45. Selikoff, I.J. and E.C. Hammond, 1975: Multiple Risk Factors in Environmental Cancer. In: Persons at High Risk of Cancer (J.F. Fraumeni Jr., ed.), Academic Press: 467.

46. Soper, W.B. 1930: Pulmonary asbestosis: A report of a case and a review,Amer. Rev. Tuberc. 22:571

47. Still, P.M. and T. McGill, 1973: Asbestos and laryngeal cancer, Lancet: 416.

48. Tabershaw, I.R., 1968: Asbestos as an environmental hazard, J. Occup. Med., 10:32.

49. Timbrell, V., 1972: Inhalation and Biological Effects of Asbestos. In: Assessment of Airborne Particles Proceedings of Third Rochester International Conference on Environmental Toxicity (T.T. Mercer et al., eds.), Thomas, Springfield, Ill: 425.

50. Wagner, J.C. et al., 1960: Diffuse pleural mesotheliomas and asbestos exposure in the N.W. Cape province,Brit.J. Ind. Med., 17:260

51. Wagner, J.C. and G. Berry, 1973: Considerations of aetiological mechanisms and other factors - Information obtained from animal experiments. In: Biological Effects of Asbestos (P. Bogovski, et al., eds.), IARC publication No. 8, Lyon.

52. Wagner, J.C. et al, 1974: The effects of the Inhalation of Asbestos on Rats, Brit. J. Cancer, 29:252.

53. Wagoner, J.K. et al., 1965: Radiation as a cause of lung cancer among uranium miners, N. Engl. J. Med., 273:181

54. Williams, M.H., 1958: Occupational Tumors of the Bladder, In: Cancer, Vol 3 (R.W. Raven, ed.), Butterworth, London: 333.

Resource Materials

1. Tables summarizing asbestos properties.

2. Potential health hazard for persons exposed to asbestos during servicing of vehicle brake and clutch assemblies. Communication of Director of Occupational Health Surveillance and Biometrics, NIOSH, August 8, 1975.

3. EPA National Emission Standard for Asbestos (40, CFR 61.20-61.25).

4. Proposal for New Occupational Asbestos Standard (40, Federal Register 47651, October 9, 1975).

5. NAS, 1971, Asbestos, the need for and feasibility of air pollution controls, Committee on Biological Effects of Atmospheric Pollutants, National Research Council, National Academy of Science, Washington, D.C.

6. IARC, 1973: The Evaluation of Carcinogensis Risk of Chemicals to Man: Some Inorganic and Organometallic Compounds, Vol. II International Agency for Research on Cancer, World Health Organization, Lyon:17

7. Selikoff, I. J., 1976: Lung Cancer and Mesothelioma During Prospective Surveillance of 1249 Asbestos Insulation Workers, 1963-1974. In: Occupational Carcinogenesis (V. Saffiotti and J. K. Wagoner, eds.), Ann. N.Y.A.S., 271:44 p

8. Nicholson, W. J., 1976: Case Study I: Asbestos - The TLV Approach, In: Occupational Carcinogenesis (V. Saffiotti and J. K. Wagoner, eds.), Ann. N.Y.A.S., 271:152.

9. Letter from I. Selikoff to G. Paulson, November 16, 1976.

10. Sawyer, R. N., 1976: Yale Art and Architecture Building Asbestos Contamination: Past, Present, and Future. In: 1976, The Institute of Electrical and Electronic Engineers.

11. Occupational Asbestos Standard, 1976 (29, CFR 1901.1001).

12. Summary of Analytical Methods Used for Asbestos.

13. FDA Asbestos Regulation (40, Federal Register 11865, March 14, 1975).

14. Letter from Governor Byrne to Mr. R. Train, EPA Administrator, January 7, 1977.

15. Sprayed-on Asbestos Containing Materials in Buildings - Guidance Document

16. Control and Prohibition of Spray-on Asbestos Surface Coatings - Proposed Regulation, NJDEP.

17. Petition of the Natural Resources Defense Council, Inc., and the Consumer Union of USA Inc., for the Promulgation of a Rule Declaring Certain Patching Compounds to be Banned as Hazardous Substances.

STATE OF NEW JERSEY
OFFICE OF THE GOVERNOR
TRENTON
08625

BRENDAN T. BYRNE
GOVERNOR

September 18, 1978

Mr. Douglas M. Costle
Administrator
Environmental Protection Agency
401 M Street, SW
Washington, D. C. 20460

Dear Administrator Costle:

Pursuant to the Toxic Substances Control Act and the recently amended Clean Air Act and the specific authorities granted to Governors under Sections 111 and 112 of that act, I petition you to develop an enforceable federal regulation which will control asbestos contamination of buildings and structures throughout the country.*

I am especially concerned with this situation in light of Secretary Califano's recent announcement of the findings of his Department's report that a substantial number of the nation's cancer deaths over the next quarter century may well have a relationship to asbestos contamination.

On January 7, 1977, I submitted a petition to the United States Environmental Protection Agency (EPA) seeking an amendment to the national emission standards for hazardous air pollutants concerning asbestos (40 CFR 61, Subpart B). At that time, I expressed my concern with several situations discovered in this State where a potential for asbestos contamination existed as a result of spraying asbestos surface coatings and from the deterioration of coatings that have already been applied. The asbestos contamination problem associated with these applications is one of national proportions.

In response, you amended the federal regulation in June of this year to close the prior rule's loophole insofar as the use of asbestos for decorative purposes was concerned. This effectively eliminated the possibility of new cases arising involving the use of sprayed-on asbestos surface coatings.

As an integral part of that same petition, however, I also sought a federal rule requiring the removal of asbestos-containing surface coatings already in place where their deterioration could produce dangerous levels of asbestos fibers in the environment. EPA's response was the publication of a comprehensive guidance document entitled "Hazard Abatement from Sprayed Asbestos-Containing Materials in Buildings" (GCA-TR-77-39-G). This was a useful step but does not solve the problem.

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* (See Appendix 1)

As you consider new asbestos regulations pursuant to this petition, I must point out that dealing with the containment and removal of asbestos materials is extremely complex and costly. Hence, I would recommend that you seek from the Congress new legislation appropriating sufficient funds to assist the states in dealing with this situation.

The HEW study Mr. Califano discussed dealt primarily with the workplace. We cannot, as responsible government officials, encourage the correction of asbestos contamination problems in the workplace and, at the same time, tolerate the continuance of such problems in residential settings and in our public buildings. I believe that the time is right for quick and decisive measures to be implemented to reduce this potential threat to the public health.

The problem of asbestos contamination also is one component of the larger issue of the quality of interior air in workplaces and residences. The recent outbreaks of Legionnaire's Disease in New York City and other areas, with the possibility that the disease may be transmitted through air conditioning systems, is a further illustration of the need to place new emphasis on the quality of interior air. It would be helpful if the federal government could create a task force to review this issue to reassure the public that sufficient attention is being placed on air quality in our buildings equivalent to the extensive resources committed to confronting outdoor air quality problems.

I urge your prompt action on these matters, and offer the support and services of New Jersey government to assist you.

Sincerely,

GOVERNOR

APPENDIX 1

A. Section 111(g)(6) of the Clean Air Act (Act) (42 U.S.C. 7411(g)(6)) authorizes the Administrator after application by a Governor to propose emission standards for categories of sources of pollutants listed under Section 112 of the Act (42 U.S.C. 7412) for which standards have not yet been established.

B. Section 112(e)(1) (42 U.S.C. 7412(e)(1) permits the Administrator to establish design, equipment, work practice or operational standards where conventional emission standards are infeasible. Such an alternate standard could be utilized in this case.

C. Section 6(a) (15 U.S.C. 2605(a)) of the Toxic Substance Control Act Provides that:

> If the Administrator finds that there is a reasonable basis to conclude that the manufacture, processing, distribution in commerce, use, or disposal of a chemical substance or mixture, or that any combination of such activities, presents or will present an unreasonable risk of injury to health or the environment, the Administrator shall by rule apply one or more of the following requirements to such substance or mixture to the extent necessary to protect adequately against such risk using the least burdensome requirements... (Emphasis added.)

and Section 6(a)5, further provides the Administrator with authority to adopt a requirement prohibiting or otherwise regulating any manner or method of commercial use of such (toxic) substance or mixture.

D. Section 9(b) (15 U.S.C. 2608(b) of the Toxic Substances Control Act states that:

> "The Administrator shall coordinate actions taken under this Act with actions taken under other Federal laws administered in whole or in part by the Administrator..."

Hence, it would be perfectly appropriate for the Administrator to rely on both federal statutes in developing a control strategy for this carcinogenic air contaminant.

Mr. **Miller**. Dr. Holzman.

STATEMENT OF DR. RICHARD B. HOLZMAN, SUPERINTENDENT OF SCHOOLS, CINNAMINSON TOWNSHIP PUBLIC SCHOOLS, CINNAMINSON, N.J.

Dr. **Holzman**. Thank you, Mr. Chairman.

The Cinnaminson Township Board of Education appreciates the opportunity to address this committee on a matter of serious concern.

Cinnaminson is a microcosm of a problem that is growing to national concern. We were one of the first districts in the State, if not the nation, to begin to take an aggressive posture in attempting to resolve this difficult and thorny problem. I hope finally after over two years of investigation and research that we will in short order be able to get some regulation and some direction from the State and Federal agencies involved so that we will know precisely what has to be done, when it has to be done, and so forth.

Our problem is: How can the protection of people best be provided, given the range of complex factors involved in the asbestos problem?

One of the serious concerns is that no one has been able to identify precisely the nature and extent of our asbestos problem. There appears to be simply no reliable standards for evaluating the hazards of asbestos fiber concentrations in the air.

Moreover, even if reliable technical standards existed, there appears to be lack of reliable air sampling technology. Accordingly, even the experts in this area find difficulty confirming the identity and quantity of asbestos fiber content in our schools.

At the request of the New Jersey State Commissioner of Education, our school district cooperated with Mount Sinai Medical Center of New York City in a study of asbestos fiber contamination funded by a grant of the Federal Government.

Among other things, the report issued as a result of this study concluded that it was unable to make specific recommendations as to sealants, contractors who may apply them, or contractors who may remove asbestos.

Notwithstanding our efforts to identify the nature and extent of the problem, the district finds itself in a situation where the current state of the art regarding the asbestos problem is simply so inadequate that we really have no sound basis for taking definitive action at this time. We cannot get any guarantees that sealing or removal will result in total elimination of the problem.

However, given the uncertainty that exists regarding the severity of our asbestos problem and the sense of great urgency that has been created in Cinnaminson, we are met with a third factor which is that great uncertainty exists regarding the proper action to be taken to remedy the problem. We are confronted with contradictory recommendations by various State and Federal agencies.

For example, the Environmental Protection Agency recommends complete removal of all asbestos material as the only reliable way to alleviate the problem at this time. However, the district has learned that asbestos material in some of the tunnels to the U.S.

Capitol has recently been treated with a sealant at the recommendation of the Architect of the Capitol after thorough research.

A fourth factor, even if we could determine what action should be taken, is the question of how the cost of remedial action can be financed. Estimates received for the cost of asbestos removal range from $2.5 million to $4 million. At present, there is no existing source of State or Federal financial aid for this purpose. Accordingly, the cost would have to be borne by the local taxpayers.

There are approximately 4,500 residential taxpayers in the Township of Cinnaminson so that cost impact of total removal would be in the range of $500 to $1,000 per residential taxpayer, a truly heavy additional tax burden. Local financing would require that the entire cost could be financed only after a successful bond issue referendum.

With all of the uncertainties that plague the asbestos problem, it is likely that the voters would reject such a referendum. If the bond referendum were to fail, then the school district would be effectively precluded from taking further remedial action.

All of the factors mentioned so far reveal that the true nature of the asbestos problem is not a local problem that could be resolved by the Township of Cinnaminson or any other single entity. We have learned that more than an estimated 26 million tons of asbestos material are currently in place in public buildings throughout this country. This includes not only school buildings but public buildings of all types.

Cinnaminson asks for national leadership to resolve this problem of national scope; that Congress assume the leadership role so that we can move away from the existing town by town approach to the asbestos problem.

We have learned that an approximate 26 million tons of asbestos material are currently in place in schools throughout the country. Specifically, we would ask Congress to acknowledge a compelling need for improved communication and cooperation among the various Federal agencies and between the agencies at the Federal and State levels, that Congress authorize coordinated and speedy research and the creation of a consolidated data bank to improve the state of the art regarding the asbestos problem.

Further, the district asks for the development of substantive standards and technology for the elimination of the asbestos problem and the development of an efficient and effective method for remedying the problem.

We also ask that reasonable and workable procedures be established to direct Federal and State agencies in their approach to instances of suspected asbestos contamination so that official cries of alarm are not issued without concurrent, meaningful technical assistance.

Finally, we would request that the U.S. Congress act immediately to begin to consider the appropriation of the substantial funds that will be necessary to remedy the asbestos problem on a national level.

Finally, I might add that I agree with so much of what Dr. Sawyer said this morning. He is one of the most practical and reasoned voices I have heard on this very thorny problem.

I also agree with EDP that regulation is also necessary and if we leave it to voluntary compliance, I don't think it is going to happen because it leaves so many unanswered questions.

Thank you very much, Mr. Miller.

Mr. MILLER. Thank you. Mr. Weiss.

Mr. WEISS. Thank you. Mr. Smith, would you, for the benefit of the committee, give us some of the background as to how the problem came to the fore in New York City. I know that that was a very controversial situation, that highlights, some of the dangers and concerns the localities face in dealing with this kind of a problem.

Mr. SMITH. Yes, sir. There are really two chapters here. The first chapter began in late 1976, in response to the experience that Howell Township had passed through. And over a period of some months, in late 1976 and early 1977 an attempt was made to survey the New York City schools to determine the extent to which asbestos was present.

In retrospect, today we are perhaps a lot wiser. And one of the points raised this morning was driven home to us with great precision—you cannot rely on specifications to tell you very much about what building materials were used.

That survey, for example, indicated that there were 185 schools in the New York City system that had asbestos used in them. As I indicated in my earlier statement, we are now coming pretty close to 400. And we have not stopped yet. We still have half the schools to survey.

I think the other thing that was learned, and again this is why I emphasized in my testimony that I think it is an error to be thinking exclusively in terms of sprayed-on asbestos materials, or even those which are self-evidently friable. There are materials which were not exposed initially at the point of construction, such as sprayed-on fire retardants, which indeed may be friable, but which are not visible unless you look in the building to find out whether they are there. They may be behind a suspended ceiling. That requires someone doing something more than simply walking through. He may have had part of the job done for him because one of our students may have removed one or several panels in that suspended ceiling, giving him immediate access. But he may have to do a little extra work to get at it. That kind of problem was simply not dealt with at all in the first survey.

So those documents, while they helped us as we started in November of this year, were hardly what I would call a data base from which to work.

On November 1 of this year, which coincidentally was the day I became Executive Director of the Division of School Buildings, enormous attention was focused on a fire retardant sprayed on the steel beams of a school in Harlem, because of the diligence and concern and tenacity of several parents in that school who were frankly frustrated by the absence of what they thought was an adequate response to their requests to have that suspended ceiling below the steel beams repaired.

The result was they took two steps. One, they removed their children from the school. The Board of Education itself did not close that school. The parents made the decision that it was unsafe for their children and decided their children would not go until the situation was repaired. Secondly, they alerted the press.

Starting from that point, if I can take that as the beginning of Chapter Two, I think we have done a more diligent job in surveying the schools than we have done to date.

I think we have restored a sense of genuine urgency, but not panic or hysteria, in dealing with the problem.

I don't think there is any question that I am aware of anywhere now in New York City that we are complacent about the problem.

I agree with so much of what my colleagues here have said about our need for assistance. I was struck by EDF's point that they would not like to see Federal legislation replace what may be the ultimate responsibility of the private sector for assisting systems like New York City's. Perhaps legislation could be written which also takes into account the voluntary compliance of systems like New York's which states that if that action had been undertaken prior to the passage of legislation, that upon submission of adequate bills and vouchers, jurisdictions which took the step on their own might be reimbursed ex post facto. I think that would be a fair way to handle it.

We are now at a point in New York City where we have, I am happy to say, not identified any entire school as being contaminated to the extent that any one of our advisors from the outside, such as Mount Sinai, or Dr. Sawyer, believe that there is an actual and imminent health hazard. I think in candor I can certainly say, and I think many of the parents at the Harlem school that was closed on November 1 would perhaps agree with me, that had we known then what we know today, that school would not have had to be closed. We would not have been as willing to agree it should be closed if we had known then what we know today.

The damage to the asbestos containing materials in that case was really very minimal. We did use air sampling. It was very misleading, partly because there was a demolition project going on immediately across the street from the school and there were windows open in the school. And that was not known at the time that the air sample was taken by Mount Sinai when it analyzed the samples. And it was skewed.

I think one of the things that we have learned in Chapter Two is that we are not going to base any operational decisions on air sampling. We will use common sense. We will use our eyeball judgment to determine where the material is, a lab to determine what it is, and then continuing on to look at it to see what kind of access is provided to that material and the extent to which, if I can use the word, it has been accessed. That is that there was visible damage to it. And that would set our order of priorities.

Ultimately I think all of us would agree in a perfect world we would either remove, isolate, or contain all asbestos materials in every one of our schools. That is our ultimate objective.

But clearly the first target are those exposed materials which are accessible and which have been damaged, and the extent of damage will determine that first cut of work.

Mr. **Weiss**. There have been repeated cautions expressed in the course of the testimony today about not panicking, and not panicking the community. But wouldn't you say that one of the concomitants of that caution is the conviction or confidence on the part of the community that the respective government agencies are dealing openly and honestly with them. Part of what happened in New York, for example, was the demand at one point that not just one or two schools be closed but a whole slew of schools be closed, there was the fact that the report of that initial survey had been filed and forgotten and never disclosed to the public until apparently a newspaper report of the survey had been leaked?

Mr. **Smith**. I spoke in my first statement about the need to have a mutual trust of all the players involved here. And it is absolutely true. There is no doubt that initially there was considerable reluctance to accept the personnel, engineers and architects who worked for me in the Division of School Buildings as being reliable and disinterested observers and evaluators of the problem. Precisely for that reason we sought the assistance of the office of the Mayor and two mayoral agencies. The Board of Education in New York City is not directly under the Mayor. And we received enormous assistance from sanitarians from the New York City Department of Health and from the Department of Environmental Protection, Bureau of Air Resources.

Our first surveys over the first six or seven weeks following November 1 were conducted by them, and I think that having that third party involved began to demonstrate to the community or that portion of the community which was not necessarily willing to accept us initially that we were very serious indeed, that we were not attempting to run away from the problem, that we were going to deal with it head-on.

I think that goes to your final point. It is the willingness of public officials, when confronted with the problem, to address it very directly and forthrightly. I think there is a reluctance in government to say, "I don't know" and there is a reluctance in government to say "I made a mistake." I have been repeating those two phrases very, very often, frankly, in connection with this problem. I am not happy when I have to say them. But I would rather say that than come out with organs, flowers and trumpets that ultimately mean very little to anybody, except that I am ignoring the problem.

Mr. **Weiss**. In the survey that has been done in the New York City schools, is there any correlation between the seriousness of the problem or the apparent seriousness of the problem and the age of the schools involved?

Mr. **Smith**. Yes. And unfortunately it is the wrong correlation. Generally the newer the schools the more serious the problem. Because the extensive use of asbestos in the New York City school system, as I think the dates have already been given, our major time frame is 1946 to 1971. 1971 was the year New York City stopped using asbestos materials of any type in its schools, two years ahead of the Federal guidelines. From 1946 to 1971 it was used extensively for acoustical purposes, and from about 1964 to 1971 it was also used as a fire retardant on steel beams. And it is, as I said earlier, that second category that causes us the main problem, because that happens to overlap with the period we had some very defective installations.

But the bulk of our material, the square footage that we are involved with, comes in that 1946 to 1971 period.

As you go back in time, you do find asbestos in older buildings where there were modernizations and also in some cases where it is very hard to dig out and locate, wrapped around pipes, and the pipes often are overlooked. It is remarkably easy to walk by a pipe and not even notice it. And very often the pipe wrapping may have asbestos around it. That may be in a classroom where the movement of furniture or a child picking on it may cause fibers to be airborne.

You also find it in boiler rooms, custodial areas. Sometimes it is under a layer of concrete. If the concrete has been cracked over the years, the asbestos material that has been put under it to insulate will begin to become airborne.

When I say we have surveyed 550 schools, those are the newest ones we have surveyed. Those are the ones built from 1946 on in New York.

We are going to survey, needless to say, every one of our schools. And I would be, I think, somewhat daring to suggest that we are going to hit a hundred percent. We are going to come as close as we can. But there are a lot of problems we won't find, I suspect, for a while.

Mr. WEISS. Thank you very much. Thank you, Mr. Chairman.

Mr. MILLER. I must apologize, as one who is chairing this hearing. I am going to have to leave. I have to be in California later tonight. I want to thank you. I would ask Mr. Weiss to take the chair for the remainder of the hearing.

The testimony you have given is going to be very helpful to us, because you are the ones that ultimately are going to have to deal with whatever solution we come up with. And I think that your practical experience, either voluntary or involuntary, however it may have arisen in the past, is going to be very helpful as we design a program, whether it is the Howell approach, which I think is a ninety-percent reimbursement, or whether it is a question of whether all 250 of those schools need all of that asbestos ripped out immediately, or over a five-year period, or whatever it is.

We are going to need that kind of information as we start down this process.

I don't know if you were in the room this morning when the chairman, Mr. Perkins, expressed his intent to get something rolling in the legislative process to respond to the problem, and to the economics in dealing with the solution.

So I appreciate this.

The committee will hear additional individuals from States starting again Tuesday at 9:30, to get additional testimony of the magnitude of the problem in other States than those of you represented this morning.

Thank you again very much.

Mr. WEISS. Mr. Buchanan.

Mr. BUCHANAN. Thank you, Mr. Chairman. I would just like to join the gentleman from California in expressing my appreciation to the members of the panel. You have been most helpful. You may be hearing further from us as we move along.

Mr. **Weiss**. Mr. Kildee.

Mr. **Kildee**. I have no further questions.

Mr. **Weiss**. All right. Thank you very much. I, too, want to express my appreciation to all of you. Your testimony is most meaningful, because it is ultimately what we will rely on in drafting this Committee's legislation.

If anyone has anything else to add, we would welcome additional comments at this point. If not, we appreciate the patience you have demonstrated in bearing with us all day. Thank you very much.

We will reconvene a week from tomorrow, on next Tuesday morning, at 9:00 a.m.

The meeting is adjourned.

[Whereupon at 3:45 p.m. the meeting was adjourned to reconvene at 9:00 a.m., Tuesday, January 16, 1979.]

[Additional material submitted for the record follows:]

WIOES

WESTERN INSTITUTE FOR OCCUPATIONAL/ENVIRONMENTAL SCIENCES, INC.
2001 DWIGHT WAY BERKELEY, CALIFORNIA 94704 (415) 845-6476

TESTIMONY ADDRESSED TO

THE CALIFORNIA STATE DEPARTMENT OF CONSUMER AFFAIRS

HEARING ON

THE IMPACT OF BUILDINGS ON HEALTH

SAN FRANCISCO, CALIFORNIA

DECEMBER 14, 1978

ASBESTOS IN BUILDINGS

BY PHILLIP L. POLAKOFF, M.D.
DIRECTOR, WIOES

I greatly appreciate the opportunity to be able to testify in front of the California State Department of Consumer Affairs hearing on the impact of buildings on health. I am in full support of the challenges put forth by the people convening these proceedings. These being: 1. Designers must learn to use technology and sound designs to produce healthy convivial environments; 2. Public officials must insure healthy buildings; and 3. Consumers need to learn how to protect themselves from their built environment.

I would like to confine my remarks today to the issue of asbestos in buildings i.e. residencies, schools and public and private buildings. However, at a future time, I would be most willing to share my thoughts to this committee on the broader issue of the impact of buildings on health.

In recent years it has been recognized that asbestos can present a health hazard to humans, especially to workers in a wide variety of trades who are exposed to elevated levels of airborne asbestos fibers. Their families have been shown to be at increase risk of contracting specific disease entities, as well. Exposures, such as these, continuing over many years, can lead to a fibrous scarring of the lungs (asbestosis) or to cancer of various organ sites i.e. lung, gastrointestinal tract, oropharynx and possibly others. Further, a once thought to be rare malignant tumor, mesothelioma, has been shown to be closely associated with less intense asbestos exposure and is occurring with increase frequency.

The spraying of asbestos on ceilings in commercial buildings and residences, mostly for insulation against heat loss and to control noise, has been common since the early 1950's and extended into the 1970's. In Manhattan alone it is estimated that at least 100 buildings were constructed using asbestos including Madison Square Gardens, part of the World Trade Center and the 60 story Chase Manhattan Bank. Further, it is estimated that as many as a 1000 schools nationwide with 200 in California alone were built containing asbestos during this same time span. The State Department of Education is currently surveying 7,500 schools in California to determine how many contain asbestos and what the health hazards, if any, is in each.

Recently in Sonoma, two fathers who work at the Mare Island Naval Shipyard in Vallejo attended their children's kindergarten open house and noticed "something feathery" hanging from the ceiling. A piece of this material was analyzed and was shown to be 90 per cent asbestos. Even though the airborne concentrations of asbestos were well within the accepted standards, the School Board of Sonoma voted to authorize $60,000 to replace the asbestos ceilings.

Because of the health hazards previously mentioned, spraying of asbestos containing materials in the construction or repair of buildings has been strictly controlled by both Federal and State laws since 1973.

Ceilings sprayed with asbestos containing materials and already in place may present some hazard if the surface is deteriorating or shedding dust, or is disturbed by repair work or by brushing for cleaning purposes, or if the surface is struck by balls or other objects in the room. Not all sprayed ceilings contain asbestos and insulating materials in the form of tiles or sheets present little hazard unless they are broken through for repairs or alterations.

When asbestos dust is present, dry sweeping or dusting should be avoided. "Wet" techniques using damp cloths and mops should be employed. Ordinary vacuum cleaning should be avoided since it does not filter out the microscopic asbestos fibers but recirculates them into the room air.

If a sprayed ceiling is not deteriorating or crumbling and is not disturbed by repairs or alteration or by activities in the room there is little hazard. A spray coat of latex paint can help to prevent deterioration and shedding.

If a sprayed ceiling is deteriorating, it is advisable to have the material analyzed to determine the content of asbestos. Deteriorating ceilings with more than two percent asbestos should be removed. Removal is a hazardous process and should be undertaken only with expert advise or by properly trained and equipped contractors.Repair or alterations to sprayed ceilings should be done only under conditions by workers using approved type respirators, unless it has been determined that the material does not contain asbestos.

As of July 1, 1978 the State of California mandated that there be no asbestos contained in spray-on building materials. However, other building material such as floor tile continue to be manufactured and installed with no legal limit as yet established regarding maximum percent of asbestos content; although, it appears future regulation is likely.

At the present time we do not know the extent to which each of these installed materials may present a health hazard to those inadvertently exposed i.e. pupil, teacher, worker and general public.

In August, 1978 U.S. Health, Education and Welfare Secretary Joseph

A. Califano Jr. sent a memo to all state governors warning that asbestos had been found in New Jersey schools and that the U.S. Public Health Service had warned that "any exposure probably carries some risk of disease." Califano noted that it was still not possible to identify the risk for school children in buildings with asbestos.

In another study done this year by Dr. Robert N. Sawyer, a Yale University occupational health expert and asbestos consultant, he warned that school children have particular problems with asbestos because cancer caused by fibrous minerals usually take 20 to 30 years to develop. Children have a longer period in which it may develop than persons exposed in middle age or later. Further,Sawyer stated that the concentrations of children in schools and classrooms is likely to increase the exposure to asbestos in contaminated buildings.

Dr. Sawyer in his report to the New York Academy of Sciences asbestos conference in June, 1978 went on to say that " some investigators feel that susceptibility is enhanced in youth with growth and high rate of cell replication."

In addition, other authorities warn that the problem of asbestos exposure in children can greatly compound the cancer risk from smoking habits that they may pick up later. The warning also extends to teachers who smoke. The cancer risk of asbestos and cigarettes combined has been shown by researchers to outweigh the sum of the risks of either one taken separately.

Throughout the nation investigators have found asbestos in schools. In Indiana asbestos was found to date in 260 of the state's 2,262 schools with more locations expected to be identified. Connecticut has found the mineral in 45 of its schools and Massachusetts identified it in nearly 100 schools.

In conclusion, asbestos present in our residencies, schools, and buildings poses a health risk; its total significance still not completely known. The asbestos-related disease epidemic that has fallen upon us at this time must serve as a constant reminder for future generations of what can occur if toxic substances are not appropriately pre-tested before they enter into commercial use.

STATE of INDIANA

INDIANAPOLIS

STATE BOARD OF HEALTH

AN EQUAL OPPORTUNITY EMPLOYER

Address Reply to:
Indiana State Board of Health
1330 West Michigan Street
P. O. Box 1964
Indianapolis, IN 46206

January 11, 1979

Hon. Carl D. Perkins
Chairman, Committee on Education and Labor
2181 Rayburn House Office Building
Washington, D.C. 20515

Dear Congressman Perkins:

We would like to enter the following statement for the record regarding the oversight hearing on hazards associated with the presence of asbestos in schools which was held on January 8, 1979.

The Indiana State Board of Health has been aware of the potential hazards of asbestos and is currently conducting a statewide school screening program with the cooperation of Local Health Officers and local school superintendents.

The first instance of suspected asbestos in a school was reported by the Elkhart County Health Department early in 1977. A joint investigation conducted by the Elkhart County Health Department and the Division of Industrial Hygiene and Radiological Health, Indiana State Board of Health, confirmed the presence of asbestos in acoustical ceilings in specific areas of the school. Subsequent samples of air indicated presence of airborne asbestos in concentrations from 0.15 to 0.95 fibers per cubic centimeter of air. This was sufficiently close to the present occupational standard of two fibers per cubic centimeter of air to cause concern for public health.

Another situation where asbestos was present in acoustical ceilings in a school was verified in Marshall County during the early summer of 1977.

These isolated cases gave impetus for developing a standard statewide screening program for asbestos in schools. The purpose of the program is to verify the absence or presence of asbestos materials in the schools and to define the extent of the public health hazard.

The program was formulated through cooperative efforts of the Division of Industrial Hygiene and Radiological Health, the Division of Local Health Services and the Housing, Schools and Hospital Section of the Division of Sanitary Engineering, Indiana State Board of Health.

The program was announced to County and Local Health Officers and school superintendents by a joint letter from the State Health Commissioner and the State Superintendent of Public Instruction. The major emphasis of the program has been a cooperative field survey-analytical services effort between the local health jurisdictions and the Industrial Hygiene Division, Indiana State Board of Health. Existing resources within existing program priorities are being used to pursue the program.

A total of 54 local health jurisdictions participated in the initial orientations for field surveys that was conducted in December 1977 and early 1978. Field survey work has been completed by 26 local health offices with bulk samples being submitted to the Industrial Hygiene Laboratory, Indiana State Board of Health, for X-ray and microscopic analysis.

Thus far a total of 706 samples have been analyzed. These samples were distributed over 26 counties and covered 933 schools. Asbestos materials were verified by X-ray and microscopic analysis in 380 samples.

Schools with asbestos materials amounted to 25.6% or 239 schools out of the 933 schools for which surveys and analytical work were completed. Based on these results we would predict over 1,000 schools in Indiana to contain asbestos materials.

Two counties do not have any asbestos material in the schools. Five counties have had air samples taken in seven schools containing asbestos.

Reports of sampling results and general recommendations for remedial measures to minimize airborne asbestos were made. These recommendations followed the asbestos advisory of the Center for Disease Control regarding Public Health Recommendations Regarding Asbestos-Spray Building Materials.

The screening program is presently continuing until the schools in the State are surveyed.

Sincerely,

W T Paynter, MD

WILLIAM T. PAYNTER, M.D., SECRETARY
INDIANA STATE BOARD OF HEALTH

NSBA
NATIONAL SCHOOL BOARDS ASSOCIATION
1055 Thomas Jefferson Street, N.W., Suite 600, Washington, D.C. 20007/ (202) 337-7666

January 11, 1979

The Honorable Carl D. Perkins
U.S. House of Representatives
Washington, D.C. 20515

Dear Representative Perkins:

Enclosed is a copy of a statement and article which NSBA would like to enter into the hearing record on asbestos in schools.

School board members across the country are very much concerned about the threats to health caused by sprayed asbestos, and will follow closely the Committee's activities in this regard.

Very truly yours,

Michael A Resnick

Michael A. Resnick
Assistant Executive Director
for Legislation

Enc.

MAR/MNW/sbg

NSBA
NATIONAL SCHOOL BOARDS ASSOCIATION
1055 Thomas Jefferson Street, N.W., Suite 600, Washington, D.C. 20007/ (202) 337-7666

Statement Prepared for the Hearing Record

by the

National School Boards Association

on

Asbestos in Schools

for the
Subcommittee on Elementary, Secondary, and Vocational Education
of the
House Committee on Education and Labor

January 8, 1979

...SERVING AMERICAN EDUCATION THROUGH SCHOOL BOARD LEADERSHIP

Introduction

The National School Boards Association is pleased to have this opportunity to submit a statement for the record of the Subcommittee on Elementary, Secondary, and Vocational Education on the subject of asbestos in schools. The National School Boards Association is the only major education organization representing school board members -- who are in some areas called school committee members or school trustees. Throughout the nation, approximately 90,000 of these individuals are Association members. These people, in turn, are responsible for the education of more than ninety-five percent of the nation's public school children.

Currently marking its thirty-ninth year of service, NSBA is a federation of state school boards associations, with direct local school board affiliates, constituted to strengthen local lay control of education and to work for the improvement of education. Most of these school board members are elected public officials. Accordingly, they are politically accountable to their constituents for both education policy and fiscal management. As lay unsalaried individuals, school board members are in a rather unique position of being able to judge legislative programs purely from the standpoint of public education, without consideration to their personal professional interest.

Asbestos Problem in Schools

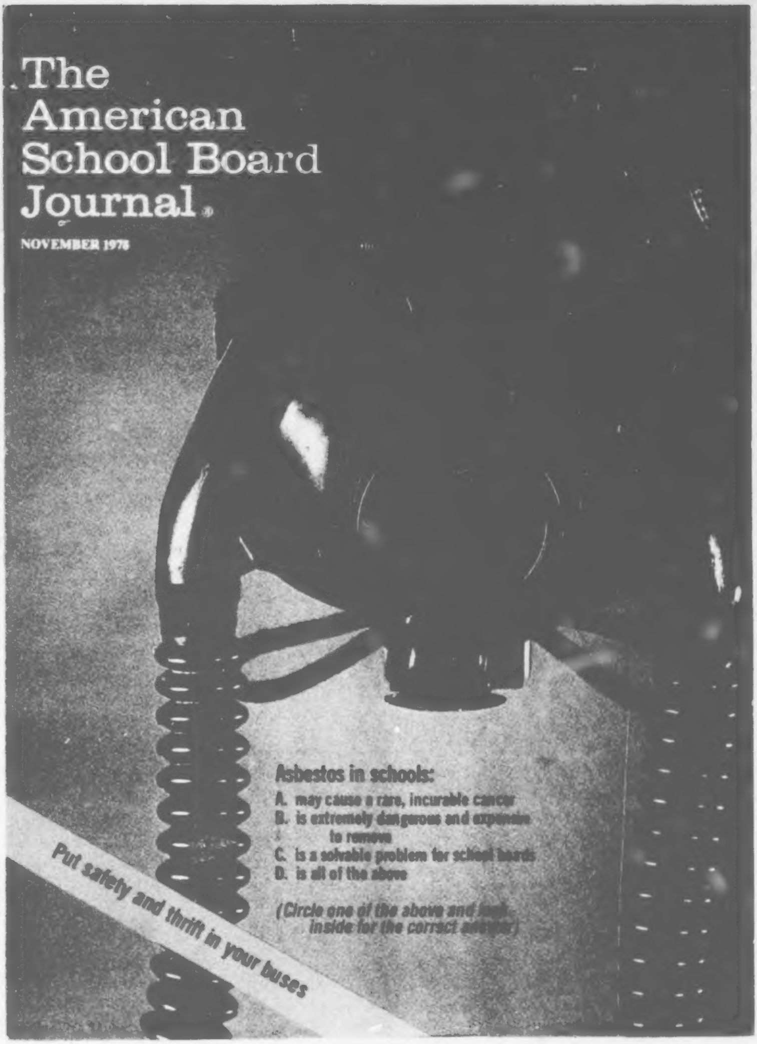
Since the health of children and school personnel is a major priority for those responsible for public elementary and secondary education, recent information concerning the hazards of sprayed asbestos in schools is of great concern to school board members across the country.

School boards face many problems regarding this matter and scientists are unsure about the proper response to the situation. For example, once the extent of the danger from sprayed asbestos in a particular school is documented, a school board must decide whether to take immediate and costly action by closing the school to remove the asbestos, or merely to seal the contaminated area. Two factors involved in this decision are the potential cost of removal, and the health hazard to workers removing the asbestos. These factors must be balanced against the risks to children, teachers, and other personnel if the asbestos is left intact. Congress, the Department of Health, Education, and Welfare, and the Environmental Protection Agency must determine quickly if legislative and regulatory actions are necessary. Of further concern to school boards is the great expense of solving the asbestos problem.

School districts will be looking to the federal government for technical and financial assistance in dealing with the problem. NSBA urges the Committee to consider ways to involve federal, corporate, and local interests in the effort to solve the asbestos problem in schools.

NSBA intends to follow the Committee's activities pertaining to the hazards of asbestos in schools. NSBA's contribution to the record at this point is the following article published in the November 1978 issue of the _American School Board Journal_, entitled, "Asbestos in Schools: Walls and Halls of Trouble."

Note: The disclaimer at the bottom of page 29 appears in every issue of the _American School Board Journal_



The American School Board Journal®

NOVEMBER 1978

Asbestos in schools:

A. may cause a rare, incurable cancer
B. is extremely dangerous and expensive
to remove
C. is a solvable problem for school boards
D. is all of the above

(Circle one of the above and look inside for the correct answer)

Put safety and thrift in your buses

Asbestos in schools: Walls and halls of trouble

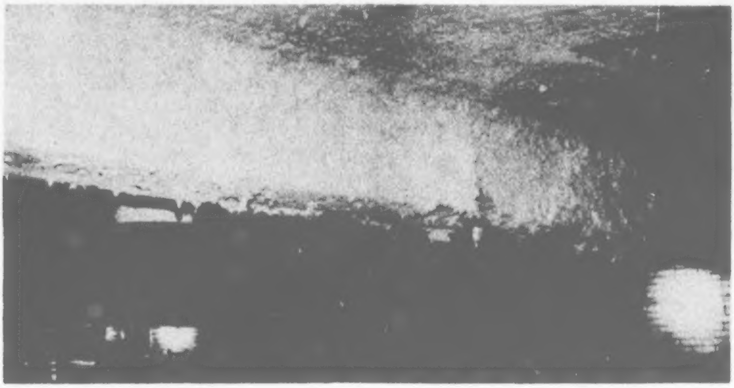
By Dan Levin

D. THAT'S RIGHT. The answer to the multiple-choice question on the front cover of this month's JOURNAL is that asbestos in schools *may* cause a rare, incurable cancer, *can* be extremely dangerous and expensive to remove and is a problem that *can* be solved by astute school boards.

If exposure to asbestos can cause cancer and if the walls and ceilings of your schools are covered with asbestos, does this mean that your students and employes face a health danger just from being inside your school buildings? That question can't be answered with a simple Yes or No; it requires replies containing "maybe" and "possibly" and "it all depends." Your responsibility in this matter, however, is clear-cut: to begin asking some key questions. Do your schools contain asbestos? To what extent is that asbestos a health hazard to students and employes? How can the health danger be eliminated? What's it all going to cost? This article is a starting point from which you can collect answers to the foregoing questions. One more thing to keep in mind: Some of the latest and best research information about asbestos in the schools (that information prompted this article and will be referred to later) may negate advice you've had in the past about asbestos in your schools. So now you have to look at the problem again; start looking here:

In schools built between 1946 and 1973, the use of asbestos, especially sprayed asbestos, was not uncommon. Builders considered it effective for fireproofing, insulation, acoustical and even decorative purposes. Because it is durable, strong, flexible and resistant to wear, asbestos has been used for an estimated 3,000 purposes in commercial, public and industrial applications. But in 1973, after research concluded that some shipyard workers who had handled asbestos during World War II were dying of cancer as a result of asbestos exposure, the U.S. Environmental Protection Agency (E.P.A.) banned its

Dan Levin is associate editor of the weekly, The American School Board Journal Insider's Report.



The sprayed asbestos on the ceiling of this storage area in a New Jersey school disintegrated spontaneously over several years. It's this type of loose, friable asbestos that poses the greatest potential for danger to your students and staff.

OPINIONS EXPRESSED BY THE JOURNAL OR ANY OF ITS AUTHORS
DO NOT NECESSARILY REFLECT POSITIONS OF THE NATIONAL SCHOOL BOARDS ASSOCIATION.

One high school spent $275,000 to seal its

use in most sprayed applications.

Asbestos workers, according to a study published last March, were dying of cancer at rates higher than those in the general population. Lung, stomach, esophageal, intestinal and rectal cancers all occurred more often among asbestos workers than normally would be expected. These findings strongly influenced recent National Cancer Institute estimates that in the next 30 years, 17 percent of all cancers will be asbestos related. But one truly significant finding of the asbestos workers study showed that seven percent of the 17,800 workers studied had died from mesothelioma—an extremely rare form of cancer in the general population that, until 1976, had not even been listed in the cancer registry. Mesothelioma affects the pleura, a membrane lining in the chest cavity, or the peritoneum, a similar lining in the abdominal cavity.

What does all this mean for students in school buildings with walls and halls of asbestos? No one is able to answer that question—not yet. Virtually all of the 4.5 million World War II shipyard workers received much higher exposures to asbestos than do students whose schools contain asbestos on the ceilings, for example. But what complicates the picture is that no air samplings were taken in World War II shipyards, so we don't know the contamination level of the air those workers were breathing. Further clouding the issue are reports that people with no history of direct exposure to asbestos—those who lived near an asbestos-producing plant or families with an asbestos worker in the household—also have contracted asbestos-associated cancers. (Predictably, smokers run an exhorbitantly higher risk of contracting asbestos-associated lung cancer than do nonsmokers who have had the same exposure to asbestos; mesothelioma, however, is not associated with cigarette smoking.) Wide disagreement exists on the matter of what constitutes a "safe" level of exposure to asbestos. And, a lack of decisive research findings has led one prominent scientist to conclude that linking low-level, nonoccupational exposure to asbestos (such as that present in school buildings containing asbestos) to cancer is "uncertain and difficult."

However: After exposure to asbestos—for as short a period as one month or two—asbestos-related cancers can take from 15 to 35 years to appear. Current studies of asbestos-related cancer reflect exposures of decades gone by. Who can say what scientists will find 20 or 30 years from now as a result of research on people exposed even to "low" levels of asbestos from 1946 until today?

No wonder there's been so much misunderstanding about schools and asbestos—misunderstanding such as that in Howell Township, New Jersey, where six elementary schools were closed in the middle of the 1976-1977 school year to remove asbestos ceilings. A parent who worked as a supervisor in the state Department of Environmental Protection, and who obviously knew something about asbestos, had a sample tested, then came to a school board meeting and declared the stuff was dangerous.

Fueling the fear in cancer-conscious New Jersey, which has the highest cancer mortality rate in the nation, was a report that at least one Howell Township child had had severely swollen glands since the start of the 1976 school year. (The malady later turned out to be mononucleosis.) Other parents were complaining that their kids were suffering from a variety of respiratory ailments; everyone was blaming asbestos. Threatened with a boycott of classes, the board of education, after an emergency meeting, ordered the schools temporarily closed in January 1977.

The president of the board agreed with the alarmed parents and said that he, too, would keep his kids out of school until the stuff was removed. He said the older kids in one school had loosened the asbestos material with yardsticks and were throwing it in other kids' faces. Superintendent Sidney Zaslavsky tried in vain to salve the situation, futilely urging the board to wait

How to take asbestos samples:

It's a simple procedure, but it requires some attention. Do not make the mistake of the Hartford administrator who said he "just cut it out" of the ceiling. The E.P.A. guidance document says, "Use a small sealable glass or plastic-capped container. Holding the container as far as possible from the face, obtain a full thickness core sample of the sprayed material by penetrating the surface with the container using a twisting motion. Any surface coating such as paint on a cement material must be penetrated. The container is then capped, wiped, and sealed with tape. Labeling should include building identification, address, building type, sample source location, and date. Disturbance of the material other than at the sampling point should be kept to a minimum. A respirator approved for asbestos dust will insure protection while performing this work. Repeat this procedure at several adjacent sites."

Edward Swoszowski, who has worked with asbestos expert Robert N. Sawyer, says samples should be taken with a container the size of an aspirin bottle. Any sprayed material, he says, should be easy to penetrate. A custodian who is going to take just one sample from a building can probably get away with holding his breath as he takes the sample, but someone who will be taking several samples will need an OSHA-approved disposable respirator that is available at most safety supply houses. Using a filter-type lab mask, says Swoszowski, "is like trying to catch sardines with a tuna net." The asbestos fibers are simply too small. Swoszowski also says to be sure to wash your hands and the bottle after sampling.

asbestos ceilings—but problems may remain

until the summer to remove the asbestos. But the state Department of Education applied pressure, according to Zaslavsky, and the job of removal began. In the end, it cost the Howell Township schools about $180,000 to remove the asbestos from the schools; elementary school students lost four weeks of classes.

Because some school officials panicked and because the testing for and removal of the asbestos may have been sloppy, several observers say the Howell Township case was mishandled from an educational as well as from a scientific standpoint. But it did spur action. In February 1977, the Massachusetts Public Interest Research Group, a Ralph Nader-inspired consumer organization, surveyed the 50 states to find out what was being done about asbestos in schools. Although the findings now may be a bit outdated, seven of the 24 states that replied were found to be only minimally aware of the potential hazards of asbestos in school buildings. Thirteen of the states reported taking some action to determine the extent of the problem, but in several cases the "action" was testing the air for asbestos—an extraordinarily unreliable method for determining danger from asbestos exposure. Unfortunately, too many administrators have been duped into believing that low readings in air samples let them off the hook.

Massachusetts, it turns out, now appears to be in the vanguard among the states that are attacking the problem. Late in 1975, two years after one city, Newton, spent a whopping $275,000 to solve the asbestos problem in a newly completed high school, the state established a legislative commission to determine the extent of the problem in the commonwealth. The state's Division of Occupational Hygiene, armed with a staff of three and funded with $50,000, sent letters to the 1,418 schools in the state that were built between 1946 and 1972 to find out if they had *any* sprayed material; 849 did. Then, borrowing 40 inspectors from the Division of Industrial Safety, occupational hygiene director Harold Bavely sent these people out to take samples from the schools. By last August, lab tests were completed in 60 percent of the 849 schools; 91 contained asbestos.

The Massachusetts State Asbestos Commission also has information that asbestos in one school may be implicated in the death of one man. William Wigmore, head maintenance man at the Hull schools from 1957 to 1966, died of mesothelioma on August 8, 1977. Wigmore had covered pipes with asbestos insulation and had used asbestos fibers to clean liquid spills.

So far, no public school in Massachusetts has removed asbestos ceilings. Newton North didn't remove its asbestos ceilings because of the extreme danger involved. Instead, according to the Newton system's Director of Support Services Roy Cornelius, some ceilings were coated (the trade term is "encapsulated"), while drop ceilings were placed beneath other areas. The school still conducts bimonthly air sampling tests with help from Harvard University scientists; the school's custodial crew has been apprised of the situation and regularly inspects ceilings for damage.

Does encapsulating asbestos or installing drop ceilings put a school in the clear? Several experts would say no.

First of all, the asbestos is still in the school. If the school ever has to be remodeled or demolished, or if there is an accident of some sort, authorities will have to deal with the problem of potential exposure. Furthermore, the sealant used to encapsulate the asbestos may be of questionable value, depending on several factors. Certain kinds of sealants applied to certain kinds of asbestos can crack when struck and this can release fibers into the air. Currently, no list of effective sealants exists. Battelle Laboratories of Columbus, Ohio, is working on an E.P.A. contract to determine the effectiveness of 70 sealants and the results should be published shortly.

Second, air sampling is an expensive, complicated process that may yield deceiving results. One reason for this is changing standards. Occupational Safety and Health Administration standards for asbestos levels in the air have changed over the last few years—"safe" levels of asbestos exposure in 1972 may, in 1978, be considered "dangerous" occupational levels.

Thus, says Dr. Robert N. Sawyer of Yale University, "Application of the OSHA standard is inappropriate and irrelevant in school buildings." Sawyer is **perhaps the country's leading expert on the asbestos problem. He is coauthor, along with Charles M. Spooner of the GCA Corp. of Bedford, Mass., of an E.P.A. guidance document, published just last March, entitled, "Hazard Abatement from Sprayed Asbestos-Containing Materials in Buildings." E.P.A., as well as other scientists, consider it the definitive work in the field. (It is available for $4.50 from the National Technical Information Service, 5285 Port Royal Rd., Springfield, Va. 22161. Cite document #EPA-450/2-78-014.)**

You should not be led into thinking that you're getting a clean bill of health when air samples of your schools show low levels of asbestos fibers in the air. Monitoring air samples to determine risk of exposure is misleading and unreliable for reasons aside from the dubious OSHA standard.

The E.P.A. guidance document describes two air sampling techniques: phase contrast microscopy and electron microscopy. The first is an optical technique not used necessarily or exclusively for asbestos; it costs $30 to $50 to perform. It simply counts the ***number of fibers of a certain size and shape.*** Therefore, many hazardous asbestos fibers may not even be counted using this method because they may be too small.

"Electron microscopy," says the guidance document, "is presently the definitive method for fiber counting and exposure estimation." But electron microscopy has its drawbacks, too, according to Sawyer. "There is presently no standard electron microscopy technique," the guidance document observes. "A provisional optimum procedure is under development by E.P.A. and is intended to increase uniformity and enhance interlaboratory agreement."

For air sampling to be truly effective, Sawyer says, a competent lab must perform several tests with several samples while normal school activity takes place—that is, while the kids walk through the halls or while the janitor sweeps up.

Electron microscopy costs $300-$500 *per sample.*

Sawyer stresses that air sampling should be used as a monitoring device before, during and after an asbestos removal or encapsulation operation. But the only effective way to determine the risk of asbestos in a school, he argues, is to take and test bulk samples of the suspected material wherever it exists. (See accompanying story on page 30.)

This, unfortunately, is easier said than done. Competent commercial laboratories are difficult to find and Sawyer hastens to add that state laboratories often are deficient, too. A horror story from an E.P.A. source, and corroborated by Sawyer, recounts how a Connecticut state lab told one school system near Hartford that it had asbestos in one school and that the ceilings should be removed. To the dismay of the schools, the "asbestos" turned out to be cellulose. But the discovery wasn't made until *after* the ceilings were removed.

The situation in New Haven was worse. Officials there were told by a state lab that certain samples contained no asbestos. But city engineer Len Smith was doubtful about the results. The city sent samples to the Mount Sinai School of Medicine in New York, which reported some samples contained as much as 35 percent to 75 percent asbestos. Smith reports two New Haven schools spent about $10,000 for small removal operations, while a larger job in Lee High School, in which the natatorium and gym required attention, cost about $20,000.

Sawyer and associates currently are at work developing an accurate technique for labs to use in analyzing asbestos samples. He's also putting the finishing touches on a condensed version of the guidance document so school board members will be able to recognize the problem and know how to deal with it rationally. According to E.P.A. Deputy Assistant Administrator for Chemical Control John De Kany, Sawyer's condensed guidance document will receive wide distribution not only among school board members but in various state and municipal offices as well.

Only two months ago, De Kany's office was in the planning stages of a project that aims to take samples from schools across the country. Personnel in the ten E.P.A. regional offices will be trained in the technical aspects of asbestos detection and will educate certain key contact people in states, municipalities and schools. De Kany hopes the voluntary survey will be completed by early next year and says that the degree to which schools cooperate will determine whether E.P.A. recommends mandatory federal regulations. De Kany says he hopes he doesn't have to recommend the regulatory approach.

While Sawyer works on his condensed guidance document for school board members and on a reliable bulk testing system, De Kany's right-hand man, Larry Dorsey, is devising a system by which commercial laboratories can become informally "accredited" in asbestos detection. It'll work like this: A central reference lab, probably Mount Sinai, will be charged with testing the samples commercial labs receive. Any lab that wants to be listed as "competent" by E.P.A. will have to split every sample it receives and send half to the reference lab, according to Dorsey.

Dorsey also has been responding to phone calls spurred by a mid-August press release by H.E.W. Secretary Joseph Califano. The release actually was a letter (to the 50 state governors) expressing concern over the asbestos problem. It also contained a report conducted by Mount Sinai's William Nicholson—"Control of Sprayed Asbestos in School Buildings: A Feasibility Study." The report, commissioned by New Jersey Rep. Andrew Maguire as a result of the Howell Township fiasco, largely reflects information in the more complete E.P.A. guidance document.

School boards will be faced with some tough "asbestos decisions" in the near future. Budgets are tight enough without the added burden of allocating funds for asbestos removal. Federal dollars are not forthcoming and it's doubtful that Congress will authorize financial assistance. A bill to grant schools 90 percent of the money needed to remove asbestos was introduced by New Jersey Rep. John Howard, who represents Howell Township, but it languished last term in the overburdened House Commerce Committee and eventually died. So: The financial consequences of removing asbestos, if your schools contain it, will be considerable. The consequences of not removing it, however, may be devastating. No one knows for sure.

One can only sympathize with plaintive Howell Township Superintendent Sidney Zaslavsky, who says, "I feel sorry for anybody who has to go through this." □

Removing

Asbestos in schools exists in several different forms, in varying concentrations and in different locations, but you should be most concerned about loose, friable asbestos that has been sprayed onto ceilings or pipes. A harder, cementitious kind, if it is smooth and intact, does not pose as immediate a threat.

Experts Robert N. Sawyer of Yale University, William Nicholson of Mount Sinai School of Medicine and John De Kany of the E.P.A. all agree on one thing: If you see a problem, you've got a problem. And, if a sprayed asbestos ceiling is damaged in any way, you have a problem.

Once you've established the presence of asbestos through competent testing, you should consider these factors:

- The higher the asbestos concentration, the more trouble you have. Even slightly damaged ceilings that contain low proportions of asbestos can pose a significant problem.
- Fiber loss from a sprayed asbestos ceiling probably increases with the ceiling's age because the material loses its cohesiveness with time.
- How accessible is the material? If it's in a gym, a student can throw a ball at it and dislodge fibers. Regular wet mopping of a gym or auditorium can help wash some fibers away.
- How is the space used and by whom? If the area is used often, then fiber counts will probably increase. If

asbestos is dangerous and messy

you have asbestos in a first-floor ceiling, don't schedule heavy activity in rooms on the second floor.

- Will maintenance crews need to penetrate or disturb the material to install light fixtures, plumbing or ventilation shafts or for cleaning purposes?
- Sprayed asbestos deteriorates from high humidity and can be damaged from leaking water.

Finally, when it comes right down to basics, many school boards will have to decide if they should seal or remove an asbestos ceiling. Don't make the decision in a vacuum. Seek professional consultants' help. Reading the E.P.A. guidance document* will help you ask contractors the right questions and enable you to check on the job they're doing. This is especially essential during a removal operation.

During removal, the work area must be totally isolated and there must be 100 percent security. Everything not bolted down should be removed from the area and anything that must remain should be sealed with plastic tarpaulin. Workers should be dressed in disposable clothing and a decontamination area should be set up adjacent to the work area, sealed off by plastic double barrier, and equipped with a shower.

While the material is scraped from the ceiling, it must be sprayed with an amended water solution. It must then be placed in thick plastic bags, which then should be stowed in sealable drums. E.P.A. has issued guidelines for disposal, which include burial in an E.P.A.-approved location. Air sampling should be conducted before, during and after removal operations.

This is by no means an exhaustive list of all the control measures necessary during an asbestos removal operation. It should, however, give you a good idea how sophisticated a removal operation is and should underscore the importance of reading the E.P.A. guidance document and of obtaining competent help for your schools. □

Removing asbestos requires intense attention to detail. The room must be sealed off, the workers protected, and the asbestos disposed of according to federal regulations.

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*"Hazard Abatement from Sprayed Asbestos-Containing Materials in Buildings" is available for $4.50 from the National Technical Information Service, 5285 Port Royal Rd., Springfield, Va. 22161. Cite document #EPA-450/2-78-014.

TESTIMONY OF THE
HONORABLE CECIL (CEC) HEFTEL
OF HAWAII

SCHOOL ASBESTOS HEARINGS

SUBCOMMITTEE ON ELEMENTARY AND SECONDARY EDUCATION

JANUARY 8, 1979

Mr. Chairman, those of us who are aware of the environmental and health hazards of abstestos fibers have a responsibility to convey that concern to the public in a well-reasoned manner. The possible asbestos hazard in our nation's schools is an emotionally charged issue. Perhaps we will accomplish nothing more significant today than to relieve the anxiety that has grown up concerning asbestos in the schools by dispassionately examining the problem and by proposing a future plan to cope with the situation on a nationwide scale.

We both conducted hearings late last year, Mr. Chairman, into the asbestos problem in the workplace -- you in San Francisco and I in Honolulu. I am sure you will agree that those hearings served the valuable purpose of expanding the public's awareness and understanding of the asbestos hazard. I am confident that the information brought out in our hearings will contribute greatly to the formulation of legislation during the 96th Congress regarding asbestos exposure. Today's hearing should be equally beneficial in formulating a policy to approach the school asbestos problem.

I am happy to report that my home state of Hawaii is moving ahead in that direction. The State Department of Education has scheduled air quality tests to begin this month to determine whether asbestos ceiling material is being released into the air. I feel it is important to note that the people of Hawaii, while expressing their legitimate concern, have maintained a sense of calm and perspective and have not allowed themselves to become frantic over a problem that has yet to be fully defined.

It is to be hoped that their attitude will be reflected elsewhere as we move closer to a complete understanding of the school asbestos problem, Mr. Chairman, and I am pleased to join with you in calling for a systematic approach to determine through tests and monitoring whether the health of our children is being imperiled and whether positive steps are therefore required to rid asbestos from our schools.

FLINTKOTE

THE FLINTKOTE COMPANY · 365 WEST PASSAIC STREET · ROCHELLE PARK, N.J. 07662 · (201) 368-9700

OFFICE OF THE TREASURER

March 8, 1979

Honorable Carl D. Perkins
Chairman House Education & Labor Committee
House of Representatives
Washington, D. C. 20515

Dear Mr. Perkins:

The objective of the "Asbestos School Hazard Detection and Control Act of 1979", HR 1524 recently introduced in the House of Representatives and considered in the March 7, 1979 mark-up session of your subcommittee is commendable. However, Section 5(b) of the proposed Bill, "Payments into the Fund" would cause an inequity which would be grossly unfair to companies innocent of any involvement in the school hazard problem.

The Flintkote Company imports and uses asbestos to manufacture relatively few products and, according to occupational safety and health regulation definitions, these products are considered nonhazardous. The asbestos fibers in these products are in a bound state and are not released into the atmosphere. To the best of our knowledge, the only Flintkote asbestos containing product used in exposed applications in school construction is floor tile which does not release asbestos fibers.

If HR 1524 is passed in its present form, The Flintkote Company and a number of other companies with similar product lines would be required to make payments into the "Asbestos Hazards Detection Fund" on the same basis as those companies responsible for the manufacture and application of products used in school construction which do release asbestos fibers into the schoolroom atmosphere. Such an arrangement would place an unfair financial burden on The Flintkote Company and others who are equally innocent of contributing to the contamination of schools.

We do not believe that industry should directly finance the cost of the school detection and control work. However, if industry funding is to be legislated, we urge you to consider the above statements and to limit, by definition in Section 5(b) of the proposed Act, contributions to the Fund to those companies producing the types of products contemplated in HR 1524. Such a modification would remove the inequity which now exists.

Very truly yours,

THE FLINTKOTE COMPANY

S. Weiss
S. Weiss
Assistant Treasurer

SW:hl
cc: Members House of Representatives

EDF

April 9, 1979

Honorable Carl D. Perkins
U.S. House of Representatives
2365 Rayburn House Office Building
Washington DC 20515

Dear Chairman Perkins:

At the Education and Labor Committee hearings several weeks ago on your proposed legislation to control asbestos emissions in public schools, we promised to supply you with detailed information on the chronology of knowledge on asbestos-related diseases, assuming we could get permission from the attorneys who had prepared such information to release it. I am sorry the process has taken so long, but am happy to report to you that we have obtained much of the requested information from the Asbestos Litigation Reporter. The original group of attorneys which we approached were reluctant to release their information, but I believe that the enclosed will more than satisfy the Committee's needs.

As you can see from the document, knowledge about asbestos disease goes back to the late 1920s. In addition, even a cursory reading of the entries will show that the industry tried to prevent the publication of much of the damaging material. We have discussed this chronology with our own consultants and have concluded that the industry had persuasive evidence that asbestos could cause lung cancer and mesothelioma by no later than the early 1950s and also recognized that asbestos was dangerous even in very low concentrations at approximately the same time. If you wish to discuss this conclusion further, we suggest that you contact Mr. Barry Castleman, our consultant on this subject. He can be reached at Box 230-A Valley Road, Knoxville MD 21758 or at 301/834-7787.

We are very anxious to see your legislation move forward in the House. As you may know, the Environmental Protection Agency has denied EDF's petition to use §6 of the Toxic Substances Control Act to control the problem. Therefore, the burden for effective action is falling increasingly to the Congress. We are considering litigating the EPA denial of our petition, but feel that congressional action is still very important.

Environmental Defense Fund, 1525 18th Street NW, Washington, DC 20036 (202) 833-1484
OFFICES IN: NEW YORK, NY (NATIONAL HEADQUARTERS); WASHINGTON, DC; BERKELEY, CA; DENVER, CO

100% RECYCLED PAPER

Please let us know if there is any further information which would be useful to you in preparing or advancing the legislation. Thank you very much for the opportunity to testify before you, and we shall look forward to working with you in the future.

Sincerely,

Robert J. Rauch

Robert J. Rauch
Washington Counsel

RJR:jas
Enclosure
cc: Barry Castleman
Steven Jellinek
Honorable George D. Miller

Asbestos Litigation Reporter

THE NATIONAL JOURNAL OF RECORD OF ASBESTOS LITIGATION, MEDICAL RESEARCH, NEW AND CONGRESSIONAL ACTIONS, AND INDUSTRY RESPONSE

Published by Andrews Publications, Inc., Edgemont, Pennsylvania 19028 (215) 353-2565.

February 7, 1979

To our subscribers:

In the last few years damage suits for personal injury and death allegedly caused by exposure to asbestos have become a major field of litigation. This legal development has followed the extensive and continuing work in medical science demonstrating and documenting the dangerous propensities of asbestos. This research continues today. At the same time the Congress, state legislatures, and federal and state administrative agencies are investigating and regulating the asbestos industry. Numerous proposals have been made for legislative intervention in asbestos litigation. This publication will publish summaries of developments in these areas.

Despite the mammoth scope of this task we intend to cover as many developments as possible. Without question, therefore, our subscribers may find some of this material familiar. We invite commentary on particular areas which this publication should focus. Our litigation information will, for example, focus initially on the following topics:

1. Liability theories (negligence, strict liability, fraud, misrepresentation, nuisance, and statutory liability);
2. Statute of limitation problems;
3. Product and defendant identification;
4. Multiple Plaintiff and class action issues, and
5. Discovery.

The topic of discovery will include reports of important developments as well as methods of limiting or broadening discovery.

We will publish a running bibliography of medical data that are available on asbestos, asbestosis, mesothelioma and related subjects. As a national journal of asbestos litigation, we plan to cover the complex issues in a responsible and useful manner for our subscribers.

As noted above, we do invite commentary or suggestions. We will also publish, from time to time, articles of common interest submitted by subscribers.

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Asbestos Litigation Reporter

February 7, 1979

A brief history of the asbestos issue

In 1906, M. Auribault, an inspector for the Department of Labor in Caen, France, linked 50 deaths to exposure to asbestos dusts in a local weaving mill, while in nearby England, the first recorded case of asbestosis was logged in a year later by Montague Murray. Although neither of these findings received much attention outside of the scientific community at the time, they stand today as the historic catalysits for subsequent research that has indicted the highly useful mineral asbestos as a crippler and a killer of mankind.

Indeed, so conclusive is the evidence against the ingestion of asbestos in its various forms that federal cancer researchers have predicted as many as 17 per cent of all cancer cases expected to occur in the United States during the next 20 years may be asbestos-related. The pervasiveness of the disease has prompted some members of the Congress to introduce legislation to extend financial assistance to those stricken or killed by asbestos-related diseases, and at the same time, has triggered thousands of law suits around the country on behalf of those allegedly injured or killed through exposure. The majority of the suits claim that industry suppressed data being unearthed about the dangers of asbestos exposure, or failed to adequately warn workers about those dangers.

This litigation, involving a cross-section of industry, will undoubtedly comprise the greatest number of court cases ever stemming from one central issue. Moreover, suits are likely to continue for years, because scientists say that it takes 20 or 30 years for the consequences of exposure to become apparent. Evidence further points out that those who worked directly with asbestos in mines and factories, or were users of asbestos products, are not the only ones to be affected. Members of their families have been stricken as well, as are those whose environment has been contaminated with the mineral's dust-like fibers.

In this first issue of the Asbestos Litigation Reporter, editors will present a chronological history of the asbestos tragedy, and reproduce documents concerning it. In subsequent issues, selected suits will be published along with records of Congressional hearings, court proceedings, and scientific data. The Reporter will seek to become the most concise, authoritative reference document on all segments of the scientific, legal and government occurrences surrounding asbestos. Moreover, it will outline and discuss the various legal issues involved.

The use of asbestos dates back thousands of years, although widespread commercial uses of the fire-resistant mineral did not occur until the latter part of the last century, when the industrial revolution created a growing need for insulation. Annual world production, only 50 tons in 1877, would reach 5 million tons 100 years later, in 1977, with its application in building and friction materials, textiles, cement, plastics and numerous other products.

The health problems associated with use of the mineral noted by Auribault and Murray had by 1913 triggered enough suspicion for the state of Iowa to enact a Workman's Compensation Law covering the disease of asbestosis, a permanent scarring of the lungs that resembles pneumoconiosis. In 1917, a paper from England detailed x-ray changes resembling pneumoconiosis in 15 individuals who had been exposed by asbestos, and a year later, the federal government in the United States, in a report on respiratory diseases in dusty trades, reported that it was the practice of the American and Canadian insurance companies not to insure asbestos workers due to their assumed health risks.

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In England, meanwhile, where the most active effort was underway to link asbestos with lung disease, doctors in 1924 reported that an autopsy of a 33-year-old woman who had worked for 20 years in an asbestos factory revealed massive deposits of asbestos dust in her lungs. Another British researcher described asbestosis and "curious bodies" originating from asbestos fibers that reach the lungs. By 1930, American scientists reported the first known case of asbestosis in the United States, and studies lead many researchers to conclude that people exposed to asbestos dust developed asbestosis if the dust concentration was high or their exposure was long.

In subsequent years, evidence linking asbestos and respiratory diseases continued to mount on both sides of the Atlantic, with the British government in 1931 making asbestosis a compensable disease under workman's compensation laws. In 1932, the first known compensation claim was paid in the U.S., to settle a suit by Addie M. Platt v. Raybestos-Manhattan Co., Hartford Accident and Indemnity Co., and The American Surety Co. The settlement totaled $2,500.

In 1933, Johns-Manville Corp. settled 11 asbestosis claims for $35,000, and obtained a covenant from the attorney representing the claimants not to bring further suits.

In 1934, Dr. Roscoe Gray, Surgical Director for Aetna Life Insurance Co., wrote: "Asbestos particles inhaled into the lung produce an exceedingly severe and perhaps fatal inflammation. This condition, called asbestosis, is not so important as many other forms of mineral irritation of the lung tissue, because of its infrequency. However, it will become more prevalent as the industry grows... Since asbestosis is incurable, and usually results in total permanent disability followed by death, care and caution should be used before a claim is assumed. This is a very serious disease... Particles once ingested continue their slow, insidious tissue destruction through the years, even though exposure may long have terminated. Death usually occurs within a year after the patient can no longer work."

In late 1934, the first in a series of highly-publicized letters between various members of the asbestos community were written. They are sure to be a focal point in contentions that industry suppressed asbestos data.

In one, from Johns-Manville attorney Vandiver Brown to Raybestos-Manhattan, an article being prepared by Dr. A.J. Lanza, medical director of the Metropolitan Life Insurance Co., on the effects of asbestos dust on workers, was discussed. Brown wrote, "I was just talking to Dr. Lanza and I am inclined to believe he will accede to most of our requests by making appropriate provisions in the article." In another letter, Brown wrote to Lanza: "All we ask is that all the favorable aspects of the survey be included and none of the unfavorable be unintentionally pictured in darker tones than the comments justify. I feel confident we can depend upon you and Dr. McConnell to give us this 'break'..."

In still another letter from Brown to Raybestos-Manhattan, Brown apologized for returning galley proofs of Dr. Lanza's article to the author without permitting Raybestos-Manhattan to review them. He said changes were suggested "that will be beneficial from the industry viewpoint. The interest of your company in the report is identical to that of Johns-Manville, and our accomplishments respecting the report will be for the benefit of both."

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Asbestos Litigation Reporter

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Continued

In 1935, the Pennsylvania Department of Labor and Industry reported that eight per cent of the workers exposed to an average dust concentration of five million particles per cubic foot had asbestosis; 22 per cent exposed at the 17 million particle level, and 57 per cent exposed at the 44 million particle level, had asbestosis. That same year, Dr. Lanza revealed his study showed 33 per cent of those examined had signs of asbestosis, although he found no evidence of marked disability. Lanza recommended that industry sponsor studies on known cases of asbestosis as well as the effect of asbestosis on the heart.

In another letter from Brown, the Johns-Manville attorney wrote Raybestos-Manhattan attorney Rummer Simpson in 1935, regarding an Asbestos Magazine request to publish data about asbestos "I quite agree with you that our interests are best served by having asbestos receive the minimum of publicity," Brown wrote. I think we should warn the publishers to use American data on the subject rather than English," British research at that time was considered far more advanced on asbestos disease than that conducted in the U.S.

Damning medical papers continued to be published in scientific circles about asbestos, and proposals were put forward to x-ray asbestos workers. In 1936, Summer Simpson wrote regarding a proposed U.S. Public Health Service x-ray survey that he didn't want the results to be given all the "shyster lawyers and doctors in the county" because of a fear they would trigger suits. Simpson's letter said he thought it would be good to have x-rays of all employees, and that if the Public Health Service conducted them, "it would be one way of getting them without arousing much suspicion on the part of employees."

In still another letter about the x-rays, Simpson says that he will permit the x-rays, but will prohibit their use. In the letter, to another attorney in the company, Simpson admonishes, "you want to stress the fact that we do not want them given to shyster lawyers and doctors so as to be the subject of suits for, as you know, we have had enough adjustments for any one company."

Simpson wrote November 10, 1936, to the president of another company, Thermal Rubber, regarding a proposal for various experiments, and cited the need for data to support industry positions. Concern is expressed by Simpson over the sequelae of asbestos exposure, especially regarding T.B. "My own idea is that it would be a good thing to distribute the information among the medical fraternity, providing it is of the right type and would not injure our companies," he wrote.

Johns-Manville's Brown also wrote Saranac Laboratories about experiments the industry had contracted for. "It is our further understanding that the results obtained will be considered the property of those who are advancing the required funds, who will determine to what extent and in what manner they shall be made public. In the event it is deemed desirable that the results be made public the manuscript of your study will be submitted to us for approval prior to publication." The following year, Brown wrote Simpson to voice concern over an early Saranac Laboratory report that one injection of asbestos caused immediate death of an animal.

In 1939, Asbestos Magazine wrote Simpson regarding Saranac's preliminary work: "Of course, we understand that all this info on asbestos is to be kept confidential and that nothing should be published about asbestos in Asbestos Magazine at present." Simpson wrote Brown of the same work, "The reports may be so favorable to us that they would cause us no trouble but they might be just the opposite which could be very embarassing."

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In still another exchange, Asbestos Magazine wrote Simpson: "We have written you many times re: publishing on asbestos, and always you have requested that for certain obvious reasons, we publish nothing, and naturally, your wishes have been respected. Possibly, a discussion of it (asbestosis) along the right lines would serve to combat some of the rather undesirable publicity given to it in current newspapers."

Simpson then wrote to Johns-Manville's Brown regarding Asbestos Magazine's request to publish: "I think the less said about asbestos the better off we are." He said the magazine had "been very decent about not reprinting the English (British) articles."

It was about this time that the industry began settling a growing number of asbestosis compensation claims, and in a bulletin for the American Society for the Control of Cancer in 1943, an author stated, "Industrial concerns are in general not particularly anxious to have the occurrence of occupational cancers among their employees or of environmental cancers among the consumers of their products made a matter of public record. Such publicity might reflect unfavorably upon their business activities and oblige them to undertake extensive and expensive technical and sanitary changes in their production methods and in the types of products manufactured. There is, moreover, the distinct possibility of becoming involved in compensation suits with extravagant financial claims by the injured parties. It is, therefore, not an uncommon practice that some pressure is exerted by the parties financially interested in such matters to keep information on the occurance of industrial cancer well under cover."

From the war years on, an avalanche of data was forthcoming from the scientific community about the relationship of asbestos to asbestosis and cancer, with industry resistance to claims of causation pretty much ending entirely in 1964, with the report of Dr. I.J. Selikoff of his study on 1,500 workers that showed a large incidence of lung cancer. Johns-Manville and many other asbestos companies that same year began issuing asbestos health warnings with their products.

Among notable epidemiologic studies into respiratory ailments this past decade that have underscored often-times complicated consequences of asbestos exposure was that of P.G. Harries in 1968. He reported that although first impressions would lead one to believe that only workers continuously exposed to asbestos are at risk of developing asbestosis, further considerations have suggested that many other workers were also at risk. Examples include workers in confined spaces where asbestos is used, such as in shipboard trades. In 1971, Raymond L.H. Murphy, Jr. found that asbestosis was 11 times more common among pipe insulators involved in new ship construction than among a control group, and that asbestosis first appeared 13 years after exposure; the prevalence was 38 per cent after 20 years. Murphy also reported a case of extensive pleural calcification in a worker whose only known asbestos exposure was during sanding asphalt and vinyl tile floors.

Lorimer et al reported in 1976 that a study of brake repair and maintenance workers exposed to asbestos revealed that 25 per cent had x-ray evidence of abnormalities consistent with asbestosis, while Meurman et al in 1973 reported a three-fold risk of dyspnea and a two-fold risk of cough for asbestos workers as compared with controls after adjusting for smoking. Other scientists reported decreased lung function in relation to increasing cumulative dust exposure in a group of asbestos cement manufacturing workers.

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Selikoff in 1976 said that a study of 232 former insulation plant employees, positive x-ray findings were found among individuals with exposures to asbestos as short as one day. And Anderson et al, that same year, reported x-ray findings consistent with asbestosis in household and family members having no known exposure to asbestos other than to have resided with a known asbestos worker.

In comparable epidemiologic studies linking asbestos with cancer, reports of lung cancer, pleural and peritoneal mesotheliomas from asbestos in its various forms have been documented. Involved are mixed fiber, crocidolite, chrysotile, amosite and anthophyllite.

A seven-fold excess of lung cancer was reported by Selikoff in 1971 among a group of insulation workers whose exposures had been to chrysotile and amosite but not crocidiolite. Philip Enterline and his associates in 1973 reported a 4.4 times increased risk of respiratory cancer mortality among retired men who had been production or maintenance employees and were exposed to mixed fibers, while those exposed to crocidolite and chrysotile in the asbestos cement industry showed a cancer rate that was 6.1 times that expected.

British scientists have found in researching the effects of crocidolite that in mining areas of South Africa tumors occurred in the non-mining population living in the vicinity of the mines and mills, as well as among workers. Alison D. McDonald reported in 1973 that his research into chrysotile showed that of 3,270 deaths among those exposed to chrysotile dust, 134 were from respiratory cancer, with 129 lung cancer and 5 mesotheliomas cases. Those most heavily exposed, he concluded, showed a five-fold cancer risk. Philip Enterline and his associates that same year reported their studies showed that production or maintenance employees in the asbestos industry who had reached 65 years of age, showed a two to four times respiratory cancer risk if they had been exposed to chrysotile.

Numerous studies have also concluded that the risk of lung carcinoma is sharply enhanced among cigarette smokers, and research by Selikoff and his associates has led them to conclude that excess lung carcinoma risks among nonsmokers is small.

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Rep. Fenwick to re-introduce comprehensive benefit bill

Rep. Millicent Fenwick (D-N.J.) will re-introduce proposed legislation this Congress seeking to provide comprehensive benefits to victims of asbestos-related diseases and their families or survivors.

The so-called "Asbestos Health Hazards Compensation Act" was introduced in the last Congress, but was not brought to a vote. Mrs. Fenwick intends to revive the bill in this session of the 96th Congress, and it is likely the House Subcommittee on Compensation, Health and Safety will hold hearings on the bill if she puts it forward.

The bill she plans to introduce will be similar to HR 8689 introduced the last session, aides say. That bill called for primary asbestos companies to pay quarterly an amount equal to 2 per cent of asbestos sales for the corresponding quarter 15 years ago. Some users would pay 1 per cent, while tobacco companies would pay 0.3 per cent on a similar assessment formula.

Rep. George Miller (D-Cal) of the Subcommittee on Elementary, Secondary and Vocational Education, who has pushed hearings on asbestos hazards, has already introduced his own asbestos bill in this Congress. The bill, HR 1524, would establish funding to inspect schools for possible asbestos exposure hazards, and provide funding to remove asbestos where removal is deemed necessary.

Work will continue on the agency level to come out with a revised, tougher exposure standard under the Occupational Safety and Health Act.

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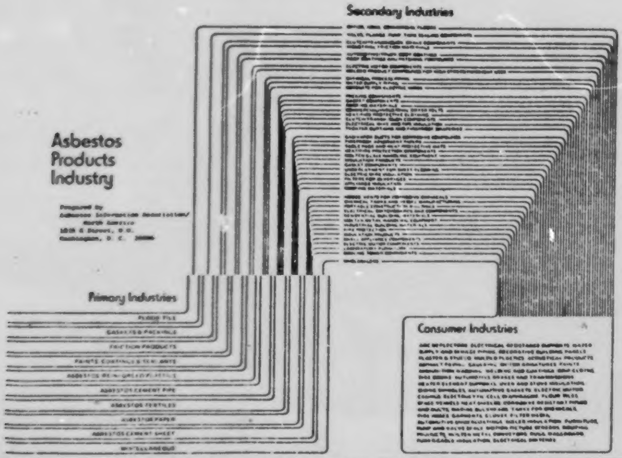
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NOTE TO SUBSCRIBERS:

The following pages contain a bibliography of asbestos highlights.

Future issues of the Asbestos Litigation Reporter will contain other data pertinent to the subject. Texts of significant memoranda, letters and reports will be published along with legal filings, etc.

The Asbestos Litigation Reporter, as a national interchange of information service, encourages you to make comments or suggest additional material and data that may be helpful to other attorneys in the nation. The Reporter is to be a national forum of asbestos legal and medical information exchange.

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ASBESTOS

CHRONOLOGICAL HIGHLIGHTS

1898	Death of Henry Ward Johns, Founder of Johns-Manville, from "dust phthisis pneumonitis," Feb. 8.
1906	Auribault, M., Note sur l'Hygiene et la Securite des Ouvriers dans les Filatures et Tissages d'Amiante. Bull. l'Inspect. Trav., 126 (1906)
	Auribault, an inspector in the Department of Labor at Caen, linked fifty (50) deaths to exposure to asbestos dusts in a weaving mill to asbestos exposure.
1907	Murray, H.M., in Report of the Departmental Committee on Compensation for Industrial Disease. Minutes of Evidence, Appendices and Index: c.d. 3495, 3496. Wyman and Sons, London, 1907; (also London: H.M. Stationery Office, p.127, HMSO, 1970, by H. Montague Murray, also in Charring Cross Gazette, London, 1900)
	Asbestos cases reported in England
1911	Collis, E.L. "Dusty Processes" Extracts from Annual Report of the Chief Inspector of factories and workshops, pp 28-30, Annual Report for 1910 reports deaths and dust controls in asbestos industry
1912	Labour Gazette (Can) Feb., pp.761-2
1913	McCrae, John "The Ash of Silicotic Lungs" Publication of the South African Institute for Medical Research. Mar.3, 1913, pp 1-7
1913	State of Iowa enacts Workman's Compensation Law covering disease of asbestosis
1913	State of Illinois enacts Workman's Compensation Law covering disease of asbestosis
1914	Fahr, Munchener Medizinische Wochenschrift p. 625, Mar. 14.
1915	State of Hawaii enacts Workman's Compensation Law covering disease of asbestosis
1916	Watkins-Pitchford, W. & Moir, J. "On The Nature Of The Doubly-Refracting Particles Seen In Microscopic Sections Of Silicotic Lungs" Public. of the South African Institute for Medical Research, Sept 14, 1916, pp 1-33.
1917	H.K. Pancoast, T.G. Miller, H.R.M. Landis, A Roentgenologic Study of the Effects of Dust Inhalation upon the Lungs, Trans. Association of American Physic., Vol. 32, May 2 & 3, 1917, pp.97-100
	Reported X-ray appearance of pneumoconiosis in fifteen individuals exposed to asbestos
1917	Higgins, Lanza et al - Bulletin 132, Bureau of Mines, pp. 81-98
1917	State of California enacts Workman's Compensation Law covering disease of asbestosis
1918	F.L. Hoffman, Mortality from Respiratory Diseases in Dusty Trades (Inorganic Dust), Bulletin U.S. Bureau of Labor Statistics No. 231, pp. 172-180, Washington, June, 1918
	Reported that it was the practice of American and Canadian life insurance companies not to insure asbestos workers due to the assumed health-injurious conditions of the industry. Referred to Murray's 1907 report.
1918	Mavrogordato. "Experiments On The Effects Of Dust Inhalation" J Hygiene - Vol. XVII, 1918, pp.439-459.
1919	State of Wisconsin enacts Workman's Compensation Law covering disease of asbestosis
1919	State of Connecticut enacts Workman's Compensation Law covering disease of asbestosis
1923	Gye, W.E. & Purdy, W.J. "The Poisonous Properties of Colloidal Silica. I. The Effects of the Parenteral Administration of Large Doses. Brit. J. Exp. Path. - Vol. 3, 1922, 75-85 II. The Effects of Repeated Intravenous Injections on Rabbits; Fibrosis of the Liver. Brit J Exp Path; Vol 3, 1922, 86-94 III. See 1924.
1922	Mavrogordato. "Studies in Experimental Silicosis and other Pneumonokonioses" Public of the South African Institute for Medical Research NO XV Mar 1922, 1-31
1924	Williams & Kerner, "Fibrosis Of The Lungs Due To The Inhalation of Asbestos Dust", by Cooke, Brit Med J, Vol II, July to Dec. p 147
1924	Gye, W.E. & Purdy, W.J. "The Poisonous Properties of Colloidal Silica. III" Brit J of Exp Path, Vol 5, 1924, 238-250.
1924	Cooke, W.E., "Fibrosis of the Lungs Due to the Inhalation of Asbestos Dust," British Journal of Medicine, II, July 26, 1924 (Republished, 1927)
	Report of death of thirty-three (33) year old woman who had worked since age 13 in an asbestos factory - Autopsy found massive deposits of asbestos dust in her lungs.
1926	Pancoast, Henry K. "Roentgenologic Studies of Pneumoconiosis and Other Fibrosing Conditions of the Lungs". Annals of Clinical Medicine 3:8-23.
1925	Pancoast & Pendergrass, "A Review of our Present Knowledge of Pneumoconiosis, Based upon Roentgenologic Studies, With Notes on the Pathology of the Condition", Amer. J. of Roentgenology, Vol. 14, 381-423.
1925	Drinker, P.: The size-frequency and identification of certain phagocytosed dusts". J Ind Hyg VII:305-316.
1927	Cooke & Hill, "Pneumokoniosis Due To Asbestos Dust," J Royal Microscopical Soc. Vol XLVIII Series III, 232-238 (enlargement on 1924 article we have)
1927	Cooke, W.E., Pulmonary Asbestosis, British Journal of Medicine, Vol. II, Dec. 3, 1927, pp. 1024, 1025
1927	McDonald, S., History of Pulmonary Asbestosis, British Journal of Medicine, Vol. II, Dec. 3, 1927, pp. 1025, 1026
	Description of asbestosis and "curious bodies" originating from asbestos fibers that reach the lungs

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1927	Sayers, R.R., "The Effects of Silica Dust Upon The Lungs" Amer. J. Pub. Health, Vol. 17, 1927, 208-214.
1927	Oliver, T. "Clinical Aspects of Pulmonary Asbestosis" Brit. Med. J., Vol. II, 1927, 1026-27.
1927	Oliver, T. "Pulmonary Asbestosis In Its Clinical Aspects" Journal of Industrial Hygiene, Suppl. 9:483-485.
1928	Seiler, H.E., A Case of Pneumoconiosis. Result of the Inhalation of Asbestos Dust, British Journal of Medicine, II, Dec. 1928, p. 982
	Eleven (11) cases by pathologists at hospitals in London and Wigan and at medical schools in Leeds and Durham showing asbestosis in autopsies
1928	Simson, "Pulmonary Asbestosis In South Africa", Brit. Med. J. May 26, 1928, 885-887.
1928	Badham, "Notes on a Fine Type of Fibrous Pneumonokoniosis Produced by Silicates and Other Minerals", Studies in Industrial Hygiene #13, Report of the Director-General of Public Health, New South Wales. p 103-110.
1928	Stewart, M.J. "The Immediate Diagnosis of Pulmonary Asbestos At Necropsy", Brit. Med. J. Vol II, 1928, P. 509.
1928	Thompson, L.R., Brundage, Dean K., Russell, Albert E. and Bloomfield, J.J. "The Health of Workers in Dusty Trades". Public Health Bulletin No. 176.
1928	Editorial. JAMA 90:119:120. "Pulmonary Asbestosis".
1928	Drinker, P., Thompson, R.M. and Finn, Jane L. "Quantitative Measurements of the inhalation, retention and exhalation of dusts and fumes by man". J Ind Hyg X:13-25.
1929	Wood, W. Burton, "Pulmonary Asbestosis" Tubercle, Vol X, 353-363, May 1929.
1929	Gloyne, S. Roodhouse, "The Presence of the Asbestos Fibre in the Lesions of Asbestos Workers", Tubercle, June 1929, pp 404-407
1929	Steward & Haddow, "Demonstration of the Peculiar Bodies of Pulmonary Asbestosis ("Asbestosis Bodies") in Material Obtained By Lung Puncture and in the Sputum" J. Pathology and Bacteriology, Vol 32, p. 172
1929	Cooke, "Asbestos Dust and the Curious Bodies Found in Pulmonary Asbestosis", Brit. Med. J., Sept. 28, 1929, p 578-80. JAMA 93:1430 (1930) JIH 12:14 (1930)
1929	Haddow, A.C. Proceedings, Clinical Aspects of Pulmonary Asbestosis, British Journal of Medicine, Vol. II:982, Sept. 28, 1929, p. 580
1929	Bridge, John C., "Remarks on Occupational Dust", Brit. Med. J. Dec. 21, 1929, 1143-1147
1929	Wood, Burton, W. and Page, D.S. "A Case of Pulmonary Asbestosis" Tubercle. X:457-461
1929	Editorial. Lancet. (Wood) II:230:231.
1930	Merewether, E.R.A. and C.W. Price, Report on Effects on Asbestos Dust on the Lungs and Dust Suppression in the Asbestos Industry, H.M. Stationery Office, London (1930)
1930	Lovisetto, Domenico, "Pulmonary Asbestosis", Silicosis, Records-Intern. Conference, Johannesburg, Aug. 1930, 506-509 (Pneumoconiosis in Italy).
1930	Manno, Giovanni, "Clinical and Radiological Notes on Pneumoconiosis Due to Asbestos" Silicosis, Records-Intern. Conference, Johannesburg, Aug. 1930, p. [illegible]
1930	Hilton, [illegible].G., "Pulmonary Asbestosis: Report of a Case," Minnesota Medicine, XIII, July 1930, p. 493
1930	Wood, "A Case of Pulmonary Asbestosis: Death From Tuberculosis Two Years After First Exposure to the Dust", Tubercle. Jan. 1930, 137-138.
1930	Soper, W.B., "Pulmonary Asbestosis: A Case" American Review of Tuberculosis, XXII, 1930, p. 571-584.
1930	Wood & Gloyne, "Pulmonary Asbestosis", Lancet, Vol. 1, 1930, 3/1/30, 445-448.
1930	Haslam, J.F.C., "Pulmonary Asbestosis" Recent Advances in Preventive Medicine, 258-265.
1930	Merewether, E.R.A., The Occurrence of Pulmonary Fibrosis and Other Pulmonary Affections in Asbestos Workers, J. Ind. Hyg., 12: 198-222, 239-257 (1930)
1930	"A Study of Dust Conditions in the Bridgeport and Stratford, Conn. Plants of the Raybestos Division of the Raybestos-Manhattan, Inc."
1930	"Report of a Dust Study on the Charleston, S.C. Plant of the General Asbestos & Rubber Division of Raybestos-Manhattan, Inc."
1930	"A Study of Dust Condition in the Manheim Plant of the United States Asbestos & Rubber Divison of the Raybestos-Manhattan, Inc."
1930	Uber Verkalkungen von Pleuraschwarten; Ulrich, Roentgen-Praxis 213-222 (German)
1930	Schrandt, T.; Beitr Z. Klinik D. Tuberk. 76; 129-144, (German)
1930	Pedley, Frank, "Report of the Physical Examination and X-ray Examination of Asbestos Workers in Asbestos and Thetford Mines, Quebec, 13 pages.
1930	Lynch, Kenneth M. and Smith, Atmar W. "Asbestosis Bodies in Sputum and Lung". JAMA 95:659-661.
1930	Pedley, F.G.: Cunningham, J.G. "Asbestosis". Canadian Public Health Journal. 21:576-577.
1930	Current Comment. JAMA "Pulmonary Asbestosis" 95:1431
1930	Cooke, W.E.: Hill, C.F.: "Further observations on Pulmonary Asbestosis with special reference to asbestos dust and curious bodies found in the lungs. "Journal of the Royal Microscopical Society" L:13-19. Bull H. 6:139 (1931) JH 13:122(31)

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1930 Foreign Letters-JAMA 94:2078 "Compensation Act to be extended to Asbestosis".

1930 Merewether, E.R.A. "Pulmonary Fibrosis in Asbestos Workers" J Ind Hyg. XII:239-257.

1930 Merewether, E.R.A., A Memorandum on Asbestosis, Tubercle, Vol. 15, pp. 69-81, 109-118, 152-159

Emphasis on relation of asbestosis to dusty working conditions

1931 Gardner, L.U. and D.E. Cummings, Studies on Experimental Pneumokoniosis VI Inhalation of Asbestos Dust, Journal of Ind. Hygiene, Vol. 13 pp. 65-81, 97-114. BH 6:602 (1931)

Studies on animals

1931 Stewart, et al., Arch. Path. Vol. 12, pp. 909-16

Asbestosis in factory workers including one victim on only nine (9) months exposure

1931 Wood, W.B. and S.R. Gloyne, Pulmonary Asbestosis Complicated by Pulmonary Tuberculosis, Lancet, 2:934 (1931)

Asbestosis, factory worker

1931 British government made asbestosis a compensable disease under its workman's compensation laws.

1931 Collis, E.L. "Report on Conference between employers and inspectors concerning methods of suppressing dust in asbestos textile factories" Bulletin of Hygiene 6:861.

1931 Kroger, Elisabeth, Rostoski and Saupe. "Pulmonary Asbestosis" Bulletin of Hygiene 6:861-2. JIH 14:144(32) JIH 6(12):562 (1931)

1931 Bienther, E. "Pulmonary Asbestosis" Bulletin of Hygiene 6:862-3.

1931 Gloyne, Roodhouse "The presence of asbestos bodies in the faeces in a case of pulmonary asbestosis" Tubercle XII:158-161. JIH 13:207 (1931)

1931 Cooke, W.E. "Asbestos Dust and asbestosis bodies from the lungs of an asbestos worker" The Journal of State Medicine 39:344-348. JIH 14:66 (1932)

1931 Gloyne, S. Roodhouse "The formation of the asbestosis body in the lung" Tubercle 12:399-403. JIH 13:241 (1931)

1931 Klemperer & Rabin: "Primary Neoplasms of the Pleura" Arch. Path., Vol. 11, 1931, 385-412.

1931 Ellman, "Two Cases of Pulmonary Asbestosis", Proceedings of the Royal Society of Medicine, Vol. 24, 699-703.

1931 Lynch & Smith, "Pulomary Asbestosis II" Amer. Revue of Tuberculosis, Vol. 23, 642-660. JIH 13:241 (1931)

1931 Ellman, "Pulmonary Asbestosis" Proceed. of Royal Soc. of Medicine, Vol. 26, 526-528.

1931 Sparks, J.V. Radiology - radiologist discoveries that asbestosis can progress (worsen) even after cessation of exposure.

1931 Schuster, "Pulmonary Asbestosis in a Dog" J. of Path. & Bact., Vol. 34, Part 1, 751-757

1931 Pancoast & Pendergrass, "A Review of Pneumoconiosis Further Roentgenological and Pathological Studies", Amer. J. of Roentgenology & Radium Therapy, Vol. 26, 556-614, Oct. 1931.

1931 Discussion - Proceedings - Royal Soc. of Med., Vol. 24, 341-342

1931 Tylecote & Dunn, "Case of Asbestos Like Bodies in a Coal Miner who had never worked in Asbestos", Lancet, Vol. 221, Vol. 2 for 1931, Sept. 19, 1931, 632-3. BH 7:21 (1932)

1931 Wood & Gloyne, "Pulmonary Asbestosis Complicated by Pulmonary Tuberculosis", Lancet, Oct. 31, 934-6. BH 7:153 (1932). JIH:66 (1932)

1931 Gloyne, "A Method of Staining the Asbestosis Bodies Found in the Sputum of Asbestos Workers", J. Ind. Hygiene, March 31, 85-86.

1931 Gordon, Burgess, Jr., "Pulmonary Asbestosis" Pa. Med. J., Vol. LXI, 637-639 (1932)

1931 Seiler & Gilmour: "A Case of Pulmonary Asbestosis" Brit. Med. J. Vol. 2, 1113-1114. JIH 13:241 (1931)

1931 Simpson, F.W.: Strachan, A. Sutherland: "Asbestos Bodies in the Sputum: A Study of specimens from fifty workers in an asbestos mill". Journal of Pathology and Bacteriology 34:1-4. JIH 13:122 (1931). BH 6:403 (1931)

[illegible] Stewart, Tattersall & Haddow, "On the Occurrence of Clumps of Asbestosis Bodies in the Sputum of Asbestos Workers", J. Path. & Bact., Vol. 33, Part II, 737-741. JIH 13:78 (1933). BH 8:27 (1933)

1932 Kettle, E.H., "The Interstitial Reactions Caused by Various Dusts and their Influence on Tuberculous Infections", J. Path. & Bact., Vol. 35, Part 1, 395-405.

1932 Gloyne & Leeds, "The Asbestosis Body", Lancet, June 25, 1932, 1351-1355. JIH 14:225 (1932)

1932 Kettle, E.H.: Hilton, R.: "The technique of experimental pneumoconiosis" Lancet 1:1190-1192.

1932 Schmid, Karl Fredrich. "Uber die methodik der Herstellung und Bestimmung des in pneumonokoniotischen Gewebe abgelagerten Staubes Beitrage zur pathologischen Anatomie und zur allegemeinen Pathologie 89:93-136.

1932 Heffernan, Patrick: "Pneumonoconiosis with special reference to stonemasons "Tubercle 13:193-199. JIH 14:246 (1932)

1932 Ekman, A. "The Dust Problem" Bulletin of Hygiene 7:361

1932 Gerbis and Ucko: "Pulmonary Asbestosis" Bulletin of Hygiene 7:361

1932 Gloyne, S.R. SURVEY OF ARTICLES DUST HAZARDS AND THEIR EFFECTS J Ind Hyg 14:225

1932 Wood, W.B.: Gloyne, S.R.: "Pulmonary asbestosis complicated by pulmonary tuberculosis" J Ind Hyg 14:66-67

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1932	Bradnow, W.: "Pneumonokoniosis in its clinical aspects and its significance as an industrial disease" J IND HYG 6:66
1932	ANON. "Diagnosis of Lung Disease" The British Medical Journal 2:363-364 (Sparks) JIH 14:225 (1932)
1932	Beintker, E. "Pulmonary Asbestosis" J Ind Hyg 14:120-121
1932	Feil, A. "La Pneumoconiose des Travailleurs de L'Amiante" La Presse Medicale 103:1872-1873 (1931)
1932	"Memorandum on the Industrial Diseases of Silicosis and Asbestosis" HMSO, 18 pp.
1932	Industrial Commission of Wisconsin: "Effects of Dusts upon the Respiratory System".
1932	Gloyne, S.R. The Morbid Anatomy and Histology of Asbestosis, Tubercle, Vol. 14, pp. 445, 451, 493-497, 550-558 (1932-1933)
	Discussion of pathology of asbestosis and methods for diagnosis of asbestos bodies and asbestosis
1932	Memorandum on Silicosis and Asbestosis to English Government, H.M. Home Office, July, 1932
	Lists dusty occupations and includes repair of mattresses and sewing asbestos
1932	Russell, A.E., Proceedings of a Conference Concerning Effects of Dusts Upon the Respiratory System, November 16-17, 1932, Democrat Printing Co., Madison, Wis.
	Conference attended by Drs. Leroy Gardner and O.A. Sander later affiliated with the asbestos industry
1932	Russell (USPHS) reports case of asbestosis in a building maintenance worker who was compensated for disability
1932	Addie M. Platt v. Raybestos-Manhattan Company, Hartford Accident and Indemnity Company and The American Surety Company, Connecticut
1933	Donnelly, Jr., "Pulmonary Asbestosis," American Journal of Public Health, XXIII, p. 1275
	Physician report that workers discovered hazard of asbestos exposure work and left job
1933	Jones, "Silicotic Lungs: The Minerals They Contain" J. of Hygiene, Vol. 33, 307-329
1933	Gloyne, "The Morbid Anatomy and Histology of Asbestosis", Tubercle, Vol. 14, July 33, 445-451. BH 8:311-2 (1933) JIH 15:127 (1933)
1933	Gloyne, "The Morbid Anatomy and Histology of Asbestosis", Tubercle, Vol. 14, Aug. 1933, 493-497.
1933	Gloyne, "The Morbid Anatomy and Histology of Asbestosis", Tubercle, Vol. 14, Sept. 1933. 550-558.
*1933	(One of these three contained first report of pleural cancer in an asbestotic.)
1933	Merewether, "A Memorandum on Asbestosis", Tubercle, Vol. 14, Nov. 1933, 69-81
1933	Merewether, "A Memorandum on Asbestosis", Tubercle, Vol. 14, Dec. 1933, 109-118
1933	Ellman, P., Pulmonary Asbestosis: Its Clinical, Radiological and Pathological Features, and Associated Risk of Tuberculosis Infection, J. Ind. Hyg., Vol. 15, pp. 165-183 (1933)
	Reported asbestosis in one insulator without high dust exposure
1933	Reed, Jerome, "Calcification of the Pleura", Annals of Int. Med., Vol. 7, 1295-1307
1933	Stack, George A.: "Pulmonary Asbestosis" Medical Bulletin of the Veteran's Administration IX:126-129. JIH 16:103 (1934)
1933	Bloomfield, J.J. "The size-frequency of Industrial Dusts" Public Health Reports-U.S.P.H.S. 48: 961-968
1933	Page, Robert C.: "A study of the sputum in pulmonary asbestosis" The American Journal of Medical Sciences 189:44-45
1933	Johns-Manville Company board of directors meeting. Company settles eleven (11) asbestosis claims for $35,000.00 and obtains covenant from attorney to not bring further suits
1933	Minutes of November 15, 1933, meeting between Lanza, Brown (Johns-Manville), Simpson (Raybestos-Manhattan), Lanza discuss desire to complete study begun three years earlier
1934	Ellman, "Part III - Pulmonary Asbestosis" Brit. J. Radiol., Vol. VII, 281-295. JIH 16:103 (1934); BH 9:592 (1934) Also reports insulator asbestosis case
1934	Wood, "Pulmonary Asbestosis - A Review of One Hundred Cases", Lancet, Vol. II, Dec. 22, 1934, 1383-1385. JIH 16:35 (1935); BH 10:219 (1935)
	Reports at least three cases of asbestosis from less than one year of asbestos exposure, one in a clerical worker, two in workers handling asbestos outdoors, and two cases with carcinoma of the lung.
1934	Merewether, "A Memorandum on Asbestosis", Tubercle, Jan. 1934, Vol. XV, 132-139. JIH 16:36 (1934); BH 9:30 (1934)
1934	McCann, Hurtado, Keltreider & Fray, "The Estimation of Functional Disability in the Pulmonary Fibroses", JAMA, Sept. 15, 1934, Vol. 103, No. 1, 810-815
1934	"Asbestosis - Part I", Comm. of Pa. Dept. of Labor & Industry, 8 pages.
1934	Miller, John W.: Sayers, R.R. "The physiological response of the peritoneal tissue to dusts introduced as foreign bodies" Public Health Reports-USPHS 49:80-89
1934	Wood, W. Burton: "Pulmonary Asbestosis" The British Journal of Radiology 7:277-280. JIH 16:102(1934); BH 9:398 (1934)
1934	Berger, P.I. "Asbestosis Bodies" J Ind Hyg 16:36 (ABSTR) Bull. MEM Soc Med Hop Paris #23 (June 1933)
1934	Oliver T.: "Pulmonary Asbestosis" J Ind Hyg 16: 128 (1933)

1934 Beger, P.J. "Uber den Schadigungsfaktor bei Asbestosis und Silikosis Medizinische Klinik 30:1222-1227. BH 10:145 (1935); JIH 17:32 (1935)

1934 Hurlbut, Cornelius S.; Williams, Charles R. "The Mineralogy of Asbestos Dust" J Ind Hyg 16:289-293 (11/33) BH 11:257 (1936); (PB) Col 36 (sp) 513 (1936)

1934 Hertz, L. "Asbestosis and Tuberculosis of the Lungs" J Ind Hyg 16:6

1934 Dyson, J.M. "Pulmonary Heart Disease in Pneumoconiosis" J Ind Hyg 16:32

1934 Beger, P.I.: "Injurious Factors in Asbestosis and Silicosis: J Ind Hyg 16:32

1934 Beger, P.I.: "More on asbestosis Bodies" J Ind Hyg 16:30-33. Virchow's Arch. 293:530-9

1934 Beintker E. "Asbestosis bodies" J Ind Hyg 16:33. Virchow's Arch. 293:537-9 (1934)

1934 Waring, James J. & Black, W.C. "The Syndrome of Obstruction in the Lesser Circulation" Amer. J of the Medical Sciences 187:653-662

1934 Gray, Roscoe N., M.D., Attorney's Textbook of Medicine, Matthew Bender & Company (1934)

Gray was Surgical Director for Aetna Life Insurance Company. He wrote:

> Asbestos particles inhaled into the lung produce an exceedingly severe and perhaps fatal inflammation. This condition, called asbestosis, is not so important as many other forms of mineral irritation of lung tissue, because of its infrequency. However, it will become more prevalent as the industry grows... Since asbestosis is incurable, and usally results in total permanent disability followed by death, care and caution should be used before a claim is assumed.
>
> This is a very serious disease and is practically incurable. Particles once ingested continue their slow, insidious, tissue destruction through years, even though exposure may long have terminated... Death usually occurs within a year after the patient can no longer work.

1934 **December 13, Letter from Attorney Hobart to Brown, Legal Department of Johns-Manville Company.**

Reports he has compared galleys with preliminary report of three years earlier. Suggests elimination of comparison of silicosis with asbestosis because of pendency of workmen's compensation legislation in New Jersey where Johns-Manville was lobbying against recognition of asbestos as an occupational disease.

> "... and it is the policy of Johns-Manville to oppose any bill that attempted to include asbestos as compensable, it would be very helpful to have an official report to show that there is a substantial difference between asbestosis and silicosis and by the same token, it would be troublesome if an official report should appear from which the conclusion might be drawn that there is very little, if any, difference between the two diseases."

Explains state of art of defense being used by Johns-Manville in common law suits by employees. Complains that plant X is described as: "unnecessarily dusty." Says he knows X isn't Johns-Manville plant, but wonders "whether the proprietor of Plant X has had an opportunity to review the comment." Concludes that comment indirectly concerns Johns-Manville and requests that it be deleted. Objects to phrase in this conclusion which apparently compared asbestos dust to granite dust as Hobart feared that the conclusions might suggest a "possibility that a pneumoconiosis may arise more readily from asbestos than granite dust." Therefore, Hobart suggests elimination of this part of the conclusion. Suggests that recommendation 4 be softened by inclusion of "possible" before "studies." Brown's think his suggestion was "important."

1934 December 18, Letter from Brown (Legal Dept. Johns-Manville) to Judd (Raybestos-Manhattan). Brown forwards galleys, his and Attorney Hobart's comments to Judd:

> "I was just talking to Dr. Lanza and I am inclined to believe he will accede to most of our requests by making appropriate provisions in the article."

1934 December 21, Letter from Brown (Legal Dept. Johns-Manville) to Lanza. Returns galleys to Dr. Lanza with Hobart's comments:

> "I trust you will give" Hobart "your most serious consideration."

Says they are not suggesting that any scientific facts or inevitable conclusions be altered.

> "All we ask is that all of the favorable aspects of the survey be included and that none of the unfavorable be unintentionally pictured in darker tones than the comments justify. I feel confident we can depend upon you and Dr. McConnell to give us this 'break'..."

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1936 December 24, Letter from Brown to Judd (Raybestos-Manhattan). Apologizes for requesting return of galley prior to Raybestos-Manhattan review, but this was necessitated because of publication date pressure and failure to promptly remit would have resulted in papers publications "as it stood." Touts efforts of he and Hobart in suggesting changes:

> "that will be beneficial from the Industry viewpoint. The interest of your company in the Report is identical to that of Johns-Manville and our accomplishments respecting the report will be for the "benefit of both."

1935 Gloyne, Two Cases of Squamous Carcinoma of the Lung Occurring in Asbestosis," Tubercle, Oct. 1935, Vol. 17, 5-10, JIH 18:8 (1936); BM 11:183 (1936)

1935 Egbert, Pulmonary Asbestosis - Report of a Case with Necropsy Findings," Amer. Rev. of Tuberc., Vol. 31, 25-34. AJR 36:1383 (1936); JIH 5-17-35:59

1935 Lanza, A.J. and W.J. McConnell and J.W. Fehnel, Effects of the Inhalation of Asbestos Dust of the Lungs of Asbestos Workers, Publ. Health Rep., Vol. 50, pp. 1-12 (1935). JIH 17:33 (1935); BM 10:336 (1935); BE 49:98 (1935).

1935 Lynch, K.M. and W.A. Smith, "Pulmonary Asbestosis" American Journal of Cancer, XXIV, p. 56. JIH 17:80 (1935)

1935 Zaid Report, U.S. Asbestos & Rubber Division of Raybestos-Manhattan, Inc. (Manheim, Pa)

1935 White, T. Preston: "Pulmonary Asbestosis" Transactions of the Medical Society of North Carolina 82nd Annual Session pp 359-363

1935 Fulton, Dooley, Matthews and Houts: "ASBESTOS" Comm. of Penna. Dept. Labor and Industry Special Bulletin No. 42:1-18

1935 Bloomfield and Dalla Valle: "The determination and control of industrial dust" Public Health Bulletin #217 167 pages

1935 Fulton, W.B., et al. Asbestosis, Part II, The Nature and Amount of Dust Encountered in Asbestos Fabricating Plants Part III. The Effects of Exposure to Dust Encountered in Asbestos Fabricating Plants on the Health of a Group of Workers, Commonwealth of Pennsylvania, Department of Labor and Industry, Harrisburg, September 20, 1935.

Found that eight (8%) percent of the workers exposed to an average dust concentration of five million particles per cubic foot had asbestosis; twenty-two (22%) percent exposed at the seventeen million particle level and fifty-seven (57%) percent exposed at a forty-four million particle level had asbestosis.

1935 October 3, Brown (Johns-Manville) to Sumner Simpson (Raybestos-Manhattan) re: Asbestos magazine request to publish:

> "I quite agree with you that our interests are best served by having asbestos receive the minimum of publicity... I think we should warn the publishers (if they decide to publish) to use American data (generated by Lanza) on the subject rather than English."

1935 State of New York enacts Workmen's Compensation Law covering disease of asbestosis

1936 Donnelly, J., Pulmonary Asbestosis: Incidence and Prognosis, J. Ind. Hyg., Vol. 18, pp. 222-228 (1936). CML 36:319 (1935); PMJ 39:336 (1936); CAN MAJ 36:323 (1936)

Found x-ray evidence of asbestosis in 52 of 131 workers (36.4%). He stated,

> "That the serious industrial hazard of this type of work has not previously received sufficient attention is becoming more apparent. The manufacture of asbestos products has increased more than four-fold in the last 30 years, and hence, because of the greater number of workers exposed, and the more frequent the recognition as a pathological entity of the resulting pulmonary condition, the subject of asbestosis has rapidly assumed greater importance."

1936 Shull, "Asbestosis" A Roentgenologic Review of 71 Cases" Radiology, Vol. 27, 279-292. Int. MED DIG 29:348 (1936); JAMA 107:1843 (1937); JIH 19:61 (1937)

1936 Egbert & Geiger, "Pulmonary Asbestosis & Carcinoma", Amer. Rev. of Tuberc. 143-150

1936 Lanza, "Asbestosis", JAMA, Feb. 1, 1936, 368-369.

1936 McPheeters, "A Survey of a Group of Employees Exposed to Asbestos Dust", J. of Indust. Hygiene & Toxicology, Vol. 18, 229-239. CAN MED ASSN J 36: 336 (1936); BM 36:603 (1936)

1936 Amoene, A. "Asbestosis" J Ind Hyg & Tox 18:86. Abstracted from orig. ger. art.

1936 Brieker P. "The causation of pneumoconiosis" J Ind Hyg & Tox 18:334

1936 Hesper, E. "Allergy and neoplasia with special reference to occupational tumor formation" J Ind Hyg & Tox 18:140-157

1936 Dekker, A. "Asbestosis" J Ind Hyg & Tox Supp 18:133

1936 di Biasi W. "Pathological and anatomical questions in cases of pneumoconiosis: severe asbestosis: J Ind Hyg & Tox 19:277 (1937)

1936 Sundius N.; Bygden, A.: "Dust content of an asbestosis lung and the nature of asbestosis bodies" J Ind Hyg & Tox 19:317-330 (1937). CHE ABS. 18:63 (1939)

1936 Lehmann G. "The significance of nasal dust filtration in asbestosis J Ind Hyg & Tox 19:138

1936 Cournand, Andre; Brock, Henry J.; Rappaport, Israel and Richards, Dickinson W.J. "Disturbance of Action of Respiratory Muscles As A Contributing Cause of Dyspnea" Arch. of Int. Med. 57:1008-1026

1936 October 31, Letter of Sumner Simpson to Jefferds (General Asbestos and Rubber Division) regarding proposed United States Public Health Service (USPHS) x-ray survey. Doesn't want x-rays to be given to all the "shyster lawyers and doctors in the county" because of fear of suits. Says it would be good to have x-rays of all employees by USPHS without it getting in hands of others; would probably be better to let USPHS do it as "it would

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be one way of getting them without arousing much suspicion on the part of the employees" being interpreted by the employees "as having some connection with the Social Security Act." Again expresses concern over proliferation of law suits.

1936 November 5, Letter of Sumner Simpson (Raybestos-Manhattan) to Jefferds (General Asbestos and Rubber Division) regarding request of USPHS to x-ray employees at Charleston. Sumner Simpson permits x-rays, but restricts their use to public health information and

> "you want to stress the fact that we do not want them given to shyster lawyers and doctors so as to be the subject of suits for, as you know, we have had enough adjustments for any one company."

Beseeches the USPHS to help them as far as they legally can.

1936 November 10, Letter of Sumner Simpson to Schulter, President of Thermal Rubber regarding proposal for Saranac experiments cites need for data in the Court Rooms to support their position. Cite cost ($3,000 per year generally paid for by industry.) Concern is expressed over sequelae of asbestos exposure especially regarding T.B.

> "My own idea is that it would be a good thing to distribute the information among the medical fraternity, providing it is of the right type and would not injure our companies."

Suggests a meeting of Johns-Manville, Raybestos-Manhattan, Keasbey and Mattison, Asbestos Manufacturing, Thermal and Russell Manufacturing.

1936 November 20, Letter of Brown (Johns-Manville) to L.U. Gardner regarding terms of agreement for research by Saranac Laboratory for the asbestos industry:

> "It is our further understanding that the results obtained will be considered the property of those who are advancing the required funds, who will determine whether, to what extent and in what manner they shall be made public. In the event it is deemed desirable that the results be made public, the manuscript of your study will be submitted to us for approval prior to publication."

1936 Letter from L.U. Gardner, Saranac Laboratories to Sumner Simpson (Raybestos-Manhattan)

Critique of K.M. Lynch's criticism of Gardner's early theories. Suggests Lynch's cases may have been silicotics instead of or in addition to asbestotic.

1936 Charles Misinski & Julia M. Misinski v. Raybestos-Manhattan, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker, settlement of $2,100.00 in 1936.

1937 January 8, Letter of Jefferds (General Asbestos and Rubber Division) to Sumner Simpson (Raybestos-Manhattan) regarding receipt of Dr. Shull's article. Complains about medical terms in article. Is going to discuss the article with Dr. Kenneth Lynch. Decries the acceleration of articles in literature about asbestos which he says do "not tend to solve the problem, if it is a problem."

1937 Simson, "A Case of Oat Cell Carcinoma of the Lung Occurring in Asbestosis", Tubercle, Dec. 1936, 105-106

1937 Lynch, Kenneth M. "Pulmonary asbestosis" "IV. The asbestos body and similar objects in the lung" JAMA 109:1974-1978. JIH 20:30 (1938)

1937 Gardner, Leroy: "Silicosis and related conditions" J Ind Hyg & Tox 19:111-135

1937 Bloomfield and Page: "A study of dust control methods in an asbestos fabricating plant" Public Health Reports 52:1713-1727

1937 Page, Richard T. "Note on a new ocular micrometer for use in dust counting" Public Health Reports 52:1315-1316

1937 Lanza, A.J. and Vane, R.J. "Industrial Dusts and the mortality from pulmonary disease": The American Review of Tuberculosis 39:419-438

1937 Discussion of Industrial Accidents and Diseases. Gardner, L.U., Sayers, R.R. and Hunt R. participating. J Ind Hyg & Tox 19:131-2

1937 Wedel, "Asbestosis and its prevention" J Ind Hyg & Tox 19:113

1937 January 8, Letter of Jefferds (General Asbestos and Rubber Division) to Sumner Simpson (Raybestos-Manhattan) regarding receipt of Dr. Shull's article. Complains about medical terms in article. Is going to discuss the article with Dr. Kenneth Lynch. Decries the acceleration of articles in literature about asbestos which he says do "not tend to solve the problem, if it is a problem."

1937 May 26, Letter from Jefferds (General Asbestos and Rubber Division) to Sumner Simpson (Raybestos-Manhattan) enclosing a report from Dr. Sayers entitled "A Study of Dust Control Methods in an Asbestos Fabricating Plant" which Sayers wanted to publish. Jefferds is criticizing the report. Refers to experiment of cutting off exhaust fan and increasing dust count to fifty million particles per cubic foot. Jefferds is fearful that plaintiffs may seize upon this as evidence of prior negligence.

> "Of course, you, as well as other, who are competent to judge, know that nothing was known of the asbestos dust hazards, in this country, prior to 1929..."

1937 September 29, Letter of Brown (Johns-Manville to Simpson (Raybestos-Manhattan). Concerned over early Saranac Laboratory report that one injection of asbestos caused the immediate death of an animal.

1937 State of Pennsylvania enacts Workmen's Compensation Law covering disease of asbestosis

1937 State of Indiana enacts Workmen's Compensation Law covering disease of asbestosis

1937 Coli v. Raybestos-Manhattan, The American Surety Company, The Hartford Accident & Indemnity Company, The Travelers Insurance Company, Connecticut

Asbestosis compensation claim of plant worker; settlement of $3,500 in 1937

1937 Sibet v. Raybestos-Manhattan, The American Surety Company, The Hartford Accident & Indemnity Company, The Travelers Insurance Company, Connecticut

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Asbestosis compensation claim of plant worker; settlement of $4,000.00 in 1937. By letter dated September 1, 1937, of Dr. Cole B. Gibson, Superintendent and medical director, Undercliffe Sanatorium, Meriden, Connecticut, diagnosis based upon history of nineteen years as asbestos weaver, onset of symptoms, character of symptoms and stereoscopic x-ray examination

Letter dated June 16, 1937, of Dr. H.J. Antell, Bridgeport, Connecticut. With the history of exposure to asbestos of over a period of twenty years and in the presence of several negative sputa... he makes a diagnosis of bilateral pulmonary asbestosis (far advanced).

1938 Various authors edited by Lanza "Silicosis and Asbestosis" Oxford Univ. Press, 236 pages.

1938 Dreessen, W.C., J.M. Dallavalle, T.I. Edwards, J.W. Miller and R.R. Sayers, A Study of Asbestosis in the Asbestosis Textile Industry, Public Health Bulletin, No. 241, 1938

Made a recommended standard for controlling exposure to asbestos dust of five million particles per cubic foot.

1938 Nordmann, M. "The Industrial Cancer of Workmen in Asbestos "Ztschr. Krebsforsch 47:288-302. CA 32:7111 (1938); JIH 20:184 (1938)

1938 Vorwald, Arthur J. and Karr, John W. "Pneumoconiosis and Pulmonary Carcinoma" The American Journal of Pathology 14:49-57

1938 Anderson, C. and Dible, Jr. Henry: "Silicosis and Carcinoma of the Lung" The Journal of Hygiene 38:185-204

1938 Gardner, L.U. "Etiology of Pneumoconiosis" JAMA 111:193-1936

1938 Prochet, P. "The prevention of asbestosis in industry" Bulletin of Hygiene 13:272-273. JIH 20:161 (1938)

1938 Sparks, J.V. "Asbestosis", The British Journal of Radiology 11:371-377

1938 Windel, T. "Asbestosis and its Prevention" J Ind Hyg & Tox Supp 20:107

1938 Gloyne, S.R. and Merewether, ERA./ "Asbestos" J Ind Hyg & Tox 20:130

1938 Wernig, F. "Clinical considerations of the question of industrial cancer of the asbestos worker" J Ind Hyg & Tox Supp 20:184

1938 Vorwald, Arthur J. and John W. Karr, "Pneumoconiosis and Pulmonary Carcinoma," American Journal of Pathology, XVIII, p. 49

Report of Saranac Laboratory (relationship of doctors and industry not disclosed)

1938 Stanley Dudzinski v. Raybestos-Manhattan, The American Surety Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; settlement in 1940 of $850.00

1938 Asbestosis in insulation workers in Finland compensated for disability

1939 3rd Survey-Stratford, Conn. Plant - Raybestos Division of Raybestos-Manhattan Inc.

1939 Lynch, Kenneth M., Smith, W. Atmar. "Pulmonary Asbestosis - V. A Report of Bronchial Carcinoma and Epithelial Metaplasia" The American Journal of Cancer 36:567-573. JIH 22:18 (1940)

1939 Klotz, Max O. "The Association of Silicosis and Carcinoma of the Lung." The American Journal of Cancer. 35:38-49

1939 Sayers, R.R. and Dreessen, W.C. "Asbestosis" American Journal of Public Health and the Nation's Health 29:205-214

1939 Various Authors edited by Lanza A. "Silicosis and Asbestosis" Industrial Hygiene, 387-389

1939 Stewart, M.J. Microscopic Technique—A Concentration Method for the Demonstration of Asbestos Bodies in the Sputum" Journal of Technical Methods. 12:70-71

1939 George, Ariel W., and Leonard, Ralph D. "An x-ray Study of the Lungs of Workmen in the Asbestos Industry Covering a Period of Ten Years" Radiology 33: 196-202. JIH 22:83 (1940)

1939 Raupe, S. "Further Contributions to Roentgenological Diagnosis of Asbestosis" J Ind Hyg & Tox 21:197

1939 Ahlermann, E. "Technical Health Protection in Asbestos Working Plan J Ind Hyg & Tox 21:181

1939 Rosler, H.U. "Asbestosis" Deutsche Medizinische Wochenschrift 65:487-488.

Notes that state insurance carriers in Germany are paying death benefits for slight asbestosis and lung cancer

1939 March 22, Letter of Sumner Simpson (Raybestos-Manhattan) to Asbestos Magazine re Dreessen article

> "I think when we get through with our Saranac investigation, we will show that this paper is considerably distorted although he does say at last that where the air can be kept down to five million microns (wrong) there is no danger, and I can tell you confidentially, but I am not willing to make it public, that the air can be kept below five million microns with proper controls, but I am not willing to start a controversy with my competitors."

Says he and Johns-Manville will share dust control secrets with competitors "when the time is right." Says he knows the plants studied by Dreessen:

> "And as nearly as I can find out they have no dust control at all that amounts to anything."

1939 March 23, Letter of Asbestos Magazine to Sumner Simpson (Raybestos-Manhattan) re: Gardner's preliminary work:

> "of course, we understand that all this info on asbestos is to be kept confidential and that nothing should be published about asbestos in Asbestos Magazine at present."

1939 May 4, Letter fr Sumner Simpson to Brown (Johns-Manville). Sumner Simpson (Raybestos-Manhattan) agrees that Gardner has violated their agreement.

> "the reports may be so favorable to us that they would cause us no trouble but they might be just the opposite which would be very embarassing."

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1939 Letter of Asbestos Magazine to Sumner Simpson (Raybestos-Manhattan):

> We have written you many times re: publishing on asbestos "always you have requested that for certain obvious reasons, we publish nothing, and naturally, your wishes have been respected."
>
> "Possibly, a discussion of it (asbestosis) along the right lines would serve to combat some of the ratehr undesirable publicity given to it in current newspapers."

1939 Letter of Sumner Simpson (Raybestos-Manhattan) to Brown (Johns-Manville) re: Asbestos Magazine request to publish:

> "I think the less said about asbestos the better off we are..."
>
> Asbestos has "been very decent about not reprinting the English articles."

1939 State of Washington enacts Workmen's Compensation Law covering disease of asbestosis

1939 State of Maryland enacts Workmen's Compensation Law covering disease of asbestosis

1939 John Haydu v. Raybestos-Manhattan, The American Surety Company, Hartford Accident & Indemnity and The Travelers Insurance Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $990.00 in 1939

1939 Mary Kisley (widow of Stephen Kisley) v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

1939 Frank Forck v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $2,000.00 in 1939

1939 Gus Varga v. Raybestos-Manhattan, Hartford Accident & Indemnity, The Travelers Insurance Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $2,500.00 in 1939

1939 Benjamin Szabo v. Raybestos-Manhattan, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $1,330.00 in 1939

1939 Steve Molnar v. Raybestos-Manhattan, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $3,000.00 in 1939

1939 Andrew Vajanyi v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $4,330.00 in 1939

1939 Joseph Tivodar v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $2,500.00 in 1939

1939 John Szabo v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connectic

Asbestosis compensation claim of plant worker; Settlement of $1,000.00 in 1939.
Letter dated July 7, 1939 from Dr. Cole B. Gibson, Undercliffe Sanatorium, claims that the occupational history (thirteen years as asbestos weaver) suggests possibility of pulmonary asbestosis. Dr. Gibson also claims the asbestosis condition improves when patient is removed from working environment

1939 Charles Brooks v. Raybestos-Manhattan, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $162.00 in 1939

1939 Alex Fekete v. Raybestos-Manhattan, The Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $300.00 in 1939

1939 Joseph F. Storm v. Raybestos-Manhattan, The Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $400.00 in 1939
Letter dated September 13, 1939, from Dr. Paul T. Longyel, Bridgeport, CT, which discoloration of lip and fingernails suggests cyanosis common in asbestos workers and the disease caused by the dust was termed "Blue disease" years ago by British doctors.

1939 John E. Nichols v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $3,000.00 in 1939

1939 John Cyane v. Raybestos-Manhattan, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $1,900.00 in 1939

1939 Joseph Szabo v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $433.00 in 1939

1939 William Fuqua v. Raybestos-Manhattan, The Travelers Insurance Company, The Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of 1,300.00 in 1939

1940 Stone, M.J., "Clinical Studies in Asbestosis", Amer. Rev. Tuberc., Vol. XLI (1940), 12-21.

1940 Wolff, A.: Nord hyg. tidskrift, 21, 1-48, Norwegian. JIH, 27:19. CA 35: 3337 (1941)

1940 Wolff, A.: Nord. Med. 5,335-341, Norwegian.

1940 Frankel, F. and Windel, T. "Protection against Asbestosis" Bulletin of Hygiene 15:346-347.

1940 Macklin, Madge Thurlow and Macklin, Charles C. "Does chronic Irritation Cause Primary Carcinoma of the Human Lung?" Archives Pathology 30:924-955

1940 Fehnel, J. Wm. "Air Sampling of Asbestos Dust" Industrial Medicine 9:5-7

1940 Cannon, G.W. "Economy of Health" J Ind Hyg & Tox 22:120

1940 Vigliani, E.C. "Two Fatal Cases of Pulmonary Asbestosis" J Ind Hyg & Tox 22:120

1940 Raumbold, L.; Rempf, E.; Wedler, H.W.: "Investigations on Pulmonary Functions in Asbestosis" JAMA 114:2513

1940 All articles contained in ZENTRALBLATT FUR GEWERBEHYGIENE UND UNFALLVERHUTUNG 27:32-33

1940 Hornig, F. "Klinische Betrachtung zur Frage des Berufskrebses der Asbestarbeiter"

1940 Von Koelsch "Lungenkrebs und Beruf"

1940 Teleky L. "Der berufliche Lungenkrebs"

1940 January 25, Letter of Dr. Alfred Kornblut to Sumner Simpson (Raybestos-Manhattan) regarding his analysis of Gardner's report

Says Dreessen study is proof positive in a human laboratory of the "hazards of the work and the end results of the effect." Quotes Dreessen Threshold Limit Value statement: Kornblut recommends:

> "Seriously face the problem of dust control where asbestos is being used" continue to make dust counts.

1940 Archie Pocolutho v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company and The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $1,330.00 in 1940
Deposition of Dr. Gibson, Undercliffe Sanatorium, states that the x-ray examination of Archie Pocolutho revealed moderate interstitial fibrosis and symptomatology coupled with the occupational history of fourteen years as asbestos weaver compatible with a moderate degree of pulmonary fibrosis which is probably due to pulmonary asbestosis

1940 Arch. f. Gewerbepath. u. Gewerbehyg. 1940, July 20, v. 10, No. 2, 123-30. (30 refs.)

Asbestosis compensated among shipyard workers in Germany. Asbestos largely substituted by other materials for insulation. Insulators taken away from asbestos exposure after two years.

1940 Pasquale Greene v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $1,330.00 in 1940

1940 Benjamin Crooks v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $1,300.00 in 1940

1941 Schrumpf, A., Nord. Med., 9, 704-706, Norweg.

1941 Desmeules, R.; Rousseau, L.; Giroux, M.; Sirois A.: "Amiantose et Cancero Pulmonaire" Laval Medicine 6:97-100

1941 Linzbach, A.J. and Wedler, H.W. "Beitrag zum Berufskrebs der Asbestarbeiter" Virchow's Archiv 307:387-400

1941 Vigliani, Enrico C. "Study of asbestosis in the manufacture of asbestos" J Ind Hyg & Tox 23:90

1941 Ellman, Philip "Pulmonary asbestosis" Proceedings of the Royal Society of Medicine 34:337

1941 Nordmann, Martin and Sorge, Adolf: "Lungenkrebs durch Asbeststaub im Tierversuch" Zeitschrift fur Krebsforschung 51:168-182

1941 November 3, Letter from Brown (Johns-Manville Legal Department) to Sumner Simpson (Raybestos-Manhattan) re: proposed review of book, "Pneumoconiosis" by Lanza

Says Johns-Manville nor Raybestos-Manhattan would object, but refers to sensitivity of rest of industry to public discussion of asbestos and specifically says:

> "I have in mind the ostrich like attitude which has been evidenced from time to time by some members of the industry."

1941 State of Delaware enacts Workman's Compensation Law covering disease of asbestosis

1941 Edgar Crowell v. Raybestos-Manhattan, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $1,000.00 in 1941

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1942 Stout & Murray, "Localized Pleural Mesothelioma", Arch. of Path., Vol. 34, 951-964.

1942 Gardner, L., "Chrysotile Asbestos as an Indicator of Subtile Differences in Animal Tissues", Amer. Rev. Tuberc., Vol. XLV, 762-772

1942 Holleb, H.B. and A. Angrist, "Bronchogenic Carcinoma in Association with Pulmonary Asbestosis," American Journal of Pathology, XVIII, p. 123

Report of two cases of asbestosis and lung cancer in asbestos insulators

1942 Hueper, W.C. "Occupational Tumors and Allied Diseases" Asbestosis - pp. 399-405

Lists asbestos as a suspect carcinogen, surveys case reports

1942 December 29, Letter from Raybestos-Manhattan to Lanza

Advises Lanza of another common law suit by ex-employee; calls treating physician a quack; related he is sending x-rays to Dr. Pendergrass:

> "Inasmuch as this claim may wind up in the Courts, I am writing you with the hopes that you may be able to render us that assistance which has been so invaluable to us in the past."

1943 Saccone, Andrea; Coblenz, Aaron. "Endothelioma of the Pleura" American Journal of Clinical Pathology, 13:186-207

1943 Homburger, F. "The Co-incidence of Primary Carcinoma of the Lungs and Pulmonary Asbestosis". American Journal of Pathology 19:797-80

1943 Wedler, H.W. "Asbestose und Lungenkrebs" (Asbestosis and Pulmonary Carcinoma) Deutsche Medizinische Wochenschrift 69:575-576. JIH&T 26:183 (1944)

Reports a series of 92 asbestotics autopsied, 8 of whom had lung cancer and 2 more having pleural mesothelioma. Notes that Federal government of Germany has recognized lung cancer as a compensable occupational disease in asbestos workers.

1943 Warren, Shields, "Minimal criteria required to prove causation of traumatic or occupational neoplasms" Annals of Surgery 117:585-595

1943 Hueper, Bulletin of the Amer. Society for the Control of Cancer, Volume 25, No. 6 (1943)

He states at page 65:

> "Industrial concerns are in general not particularly anxious to have the occurrence of occupational cancers among their employees or of environmental cancers among the consumers of their products made a matter of public records. Such publicity might reflect unfavorably upon their business activities and oblige them to undertake extensive and expensive technical and sanitary changes in their production methods and in the types of products manufactured. There is, moreover, the distinct possibility of becoming involved in compensation suits with extravagant financial claims by the injured parties.
>
> "It is, therefore, not an uncommon practice that some pressure is exerted by the parties financially interested in such matters to keep information on the occurrence of industrial cancer well under cover."

Hueper declared asbestosis lung cancer an occupational disease entity, called on industry to substitute carcinogens then in use.

1943 State of Oregon enacts Workmen's Compensation Law covering the disease asbestosis

1943 State of Nebraska enacts Workmen's Compensation Law covering the disease asbestosis

1943 State of Minnesota enacts Workmen's Compensation Law covering the disease asbestosis

1943 State of Michigan enacts Workmen's Compensation Law covering the disease asbestosis

1943 State of Arizona enacts Workmen's Compensation Law covering the disease asbestosis

1944 Kristianson, I., "Calcification of the Pleura", Acta Tuberculosea Scandinavica, Vol. 18, 310-323

1944 Gloyne, S.R. and Merewether, E.R.A. "Asbestos" International Labour Office publication Occupation and Health pp. 1-13

1944 Wedler, H.W. "Asbestosis and Pulmonary Carcinoma" Bulletin of Hygiene 19:363

1944 State of Virginia enacts Workmen's Compensation Law covering the disease asbestosis

1945 [illegible], N. "Experimental Asbestosis: pathogenesis value of asbestos bodies" Chemical Abstracts 39:366

1945 State of New Mexico enacts Workmen's Compensation Law covering the disease asbestosis

1945 State of Colorado enacts Workmen's Compensation Law covering the disease asbestosis

1945 New Jersey makes asbestosis a compensable occupational disease

1945 British Factory Inspectorate sends a letter to members of Thermal Insulation Contractors Association warning of asbestosis hazard in shipyards and suggesting control measures

1946 Fleischer, Viles, Gade & Drinker, "A Health Survey of Pipe Covering Operations in Constructing Naval Vessels", J. of Ind. Hyg. and Toxicology, Vol. 28, p. 9-16

Reports 3 cases of asbestosis among 31 insulation workmen with 10 or more years' exposure. Epidemiologic survey finding three cases of asbestos in shipyard but concludes trade isn't hazardous (no monitoring of removal of old insulation and the majority of men surveyed had less than fifteen years exposure.)

1946 Nero, L., "On the Histology of Asbestos", Acta Pathologica et Microbiologica Scandinavica, Vol 23, 33-38

1946 King, E.J., Clegg, J.W., and Rae, V.M. "The effect of Asbestos, and of asbestos and aluminum, on the lungs of rabbits". Thorax 1:188-197. JAMA 133:886 (1947)

Epidemiologic survey finding three cases of asbestos in shipyard but concludes trade isn't hazardous (no monitoring of removal of old insulation and the majority of men surveyed had less than fifteen years exposure.)

1946 August 12, Letter from Sachs (President, Sachs Corporation) to Rohrbach (Raybestos-Manhattan)

Complains that final report has not been rendered. Refers to interim reports that less than five microns is innocuous and says that heavier dust (greater than five microns) can be controlled by approved respirators

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> "With these two facts established, and without injection of possibilities of cancer, etc., we would have something definite and worthwhile to combat the claims of these country doctors' whose testimony is accepted by the Courts. Refers to fact that all they need is this part of the report and "we could let the rest of it (experiments) go by the board."

1946 December 12, Letter from Brown (Johns-Manville Legal Dept.) to [illegible] (Saranac Laboratory)

Asks whether someone else could complete Gardner's studies. Reminds Saranac of agreement that results are the property of industry and that any reports are to be approved by industry prior to publication.

1946 State of Alaska enacts Workmen's Compensation Law covering the disease, asbestosis

1946 State of Georgia enacts Workmen's Compensation Law covering the disease, asbestosis

1947 Wegelius, C., "Changes in the Lungs in 126 Cases of Asbestosis Observed in Finland", Acta Radiologica, Vol. XXVIII, 139-152. JIH & T 29:91

1947 Luton, Champion and Faure. "Asbestosis of the Lungs" Occupational Medicine 4:234

1947 Same Article abstracted in J Ind Hyg & Tox 29:91

1947 Belt, Thomas H., Friedmann, I. and King, E.J. "The effect of Asbestos on Tissue Cultures: a comparative study with quartz and coal dust" The Journal of Pathology and Bacteriology 59:159-164

1947 Hemeon, W.C.L., Report of Preliminary Dust Investigation for ATI, IHF (June, 1947 (unpublished)

The report, in part, states:

> "The maximum permissible dustiness for asbestos is commonly taken to be five mppcf. This represents good attainment in the dust control program. It is emphasized, however, that dust elimination to this extent does not positively insure that no asbestosis will develop in some workers after a long working life. (greater that twenty to twenty-five years). Scientific evidence is obscure on this point.

1947 Kennaway and Kennaway, British Journal of Cancer Volume 1, p. 260 (1947)

Autopsies of cancer victims. Included an insulator.

1947 Merewether, E.R.A., Annual Report of the Chief Inspector of Factories (London: H.M. Stationery Office) Published on January 1949

Lung Cancer rate 13.2% among asbestosis victims at autopsy, comp.

1947 Safety Review (U.S. Navy) Vol. 4, January, 1947

Cites insulators as being at risk and recommends that dust suppression measures be undertaken. Finds Threshold Limit Value exceeded in an insulation operation.

1947 Minutes, Air Hygiene Committee, ATI, November 10, 1947

Proposal made to study effects of long term low-level asbestos exposure. (Rejected, June 17, 1948)

1947 State of Tennessee enacts Workmen's Compensation Law covering the disease, asbestosis

1947 State of New Hampshire enacts Workmen's Compensation Law covering the disease, asbestosis

1947 State of Nevada enacts Workmen's Compensation Law covering the disease, asbestosis.

1948 Johnstone, R., Occupational Disease and Industrial Hygiene, P. 332

1948 Lynch, Kenneth M. and Cannon, W.M. "Asbestosis: VI Analysis of Forty Necropsied Cases". Diseases of the Chest 14:874-889. Brit J Ind Med 6:248 (1949)

1948 Bradley, Leopold: "Discussion" Diseases of the Chest 14:883-888

1948 LITERATURE REVIEW AND LISTINGS
British Journal of Industrial Medicine 5:180-183
  [illegible], L. "Some Remarks on Asbestosis"
  [illegible], M. "Experimental Asbestosis. Pathognomonic Value of the 'Asbestos Body'"
  Desoille, Girard and Richard "Asbestosis and Pulmonary Tuberculosis"
  Desoille, [illegible] Girard and [illegible] "Asbestosis and Cancer of the Lung"

1948 Cureton, R.J.R. "Squamous Cell Carcinoma Occurring In Asbestosis of the Lung" Brit. J. of Cancer 2:249-253

1948 National Insurance (Industrial Injuries) (Prescribed Diseases) Regulations 1948

1948 Willis, R., Pathology of Tumours (1948 ed.)

Textbook citing inter alia the 1943 Wellish and Angrist case report.

1948 Pneumoconiosis: Report of the Ministry of National Insurance, reported (1953)

Insulators are made eligible for Workmen's Compensation in England. Covers asbestosis.

1948 State of Arkansas enacts Workmen's Compensation Law covering the disease, asbestosis

1949 Baldwin, Cournand & Richards, "Pulmonary Insufficiency "II. A Study of 39 Cases of Pulmonary Fibrosis'", Medicine, Vol. 28, 1-25

1949 Wyers, H., "Asbestosis", PostGrad. Med. J., Vol. XXV, 631-638. BM 25:477 (1950)

1949 Fairhall, Lawrence T. "Asbestos" Industrial Toxicology 6-11:29-31

1949 Cartier, Paul, "Contribution a l'etude de l'amiantose"
Archives des Maladies Professionnelles 10:589-595
Arch Ind Hyg & Occ Med 3:428

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1949 Annual Report of the Chief Inspector of the Factories for the Year 1949, British Home Office, (1951)

He states:

> "It is very necessary to keep an ever watchful eye for the new uses of asbestos in some manufacturing or other process, for example, on ships or buildings where the work may be undertaken by someone not fully realizing the necessity of preventing as far as possible the inhalation of asbestos fiber and dust."

1949 Camblin, Graff, "Cancer and Environment" Scientific American 180:11-15

1949 Editorial, 140 Journal of the American Medical Association, 1219, "Lung Cancer" (1949)

> "Since some 20,000 workers are employed in the asbestos producing industries of this country and Canada and many additional thousands in various asbestos consuming industries, increased asbestos consuming industries, increased attention to this probable occupational hazard of cancer of the lung by the medical profession is desirable."

1949 Smith, Kenneth and Johns-Manville officers

Health survey of Johns-Manville mill and requests for funds to suppress dust inside and outside the mill in order to prevent more cases of asbestosis.

1949 Camblin

Brands asbestos as cancer agent and calls for testing and search for substitute products

1949 Franchini

Medical report of asbestosis in an insulator

1949 Asbestos strike in Quebec area. Arbitration before Quebec Labour Relations Board, December 14, 1949. Testimony from industry and private doctors on asbestos disease and exposure levels. Commitment by companies to reduce dust levels.

1949 State of West Virginia enacts Workmen's Compensation Law covering the disease, asbestosis

1949 State of South Carolina enacts Workmen's Compensation Law covering the disease, asbestosis

1949 Mary Cronce (widow of Angelo Cronce) and John Cronce v. Raybestos-Manhattan, The Travelers Insurance Company, Hartford Accident & Indemnity Company, The American Surety Company, Connecticut

Asbestosis compensation claim of plant worker; Settlement of $2,230.00 in 1949. Letter dated May 7, 1949, from Dr. A. Phillip Dinan, Jr., Stratford, Connecticut, indicates that history of exposure as a weaver for eighteen years along with clinical symptoms and x-ray findings resulted in diagnosis of asbestosis. There was a marked progression of the fibrosis from x-ray in 1947 compared to x-ray in 1949 even though employee was not exposed to asbestos dust during these two years (he worked in locker rooms as a janitor). Asbestosis, once the lungs become involved, will progress whether the man is in the environment or not.

1950 Ivo, J., Ugeskrift Laeger, 112, 472-474, Danish.

1950 Frost, Ugeskr. Laeger, Vol. 112, 1284-1289, Danish

Medical report of asbestosis in an insulator

1950 Campbell, William N. "Pleural Mesothelioma" The American Journal of Pathology 26:473-487

1950 Champion, Jr. and Bouteville, J. "Electron Microscopy of Asbestos Bodies and Fibers of Asbestos" British Journal of Industrial Medicine 7:198

1950 Saleman, E. "The Asbestosis Problem in Slovakia" Archives of Industrial Hygiene and Occupational Medicine 2:610

1950 Franchini, A. and Canepa G. "Pulmonary Asbestosis: Anatomico-pathologic study of a case" Archives of Industrial Hygiene and Occupational Medicine. 1:362-363

1951 Maxcy, K., "Occupational Diseases", Rosenau Preventive Medicine and Hygiene, p. 1032

1951 Vorwald, Durkan & Pratt, "Experimental Studies of Asbestosis" (Saranac Lake, N.Y.) Archives of Industrial Hygiene and Occupational Medicine, Vol. 3, No. 1, 1-43

(They dismiss the case studies linking lung cancer with asbestosis because the group of workers examined is not a typical, random group of asbestos worker.)

1951 Austrian, R., McClement, J., et al, "Clinical and Physiologic Features of Some Types of Pulmonary Diseases with Impairment of Alveolar-capillary Diffusion: The Syndrome of "Alveolar-capillary Block", Amer. J. of Med., Vol. 11, 1951, 637-685.

1951 Stoll, Roger; Bass, Richards; and Angrist, Alfred, "Asbestosis associated with bronchogenic carcinoma" AMA Archives of Internal Medicine 88:831-834. BM 27:444 (1952)

They concluded:

> "This association (between asbestosis and lung cancer in an insulator) emphasizes the hazards of industrial exposure, the compensability of the cancerous process as well as the asbestosis and the need of careful preventative measures."

1951 Gloyne, S.R. and Leeds, H.D. "Pneumoconiosis: A Histological Survey of Necropsy Material in 1205 Cases" Lancet 1:810-814

1951 Bohme, A. "Results of Periodical Examinations of Workers in an Asbestos Factory" Bulletin of Hygiene 26:311

1951 Smith, J. Maclean; Weston, I.D.P.; and King, E.J. "Experimental Asbestosis in Rats" Thorax 6:127-136

1951	Lepine, P. and Croissant, O. "Amorphological Study, with the Electron Microscope, of particles of Asbestos Found in the Air" Bulletin of Hygiene 26:1080
1951	Behrens, W. "Experimental Asbestosis" Bulletin of Hygiene 26:1181
1951	Wright, George W. & Filley, Giles F. "Pulmonary Fibrosis and Respiratory Function" Amer. J of Med. 10:642-661
1951	Owen, T.K. "Carcinoma and Asbestosis of the Lung: Report of A Case" Brit. J of Cancer 5:382-383
1951	Stokinger, H.E., Lobar Deposition and Retention of Inhaled Insoluble Particulates, Arch. Ind. Hyg. Occup. Med., Vol. 4, pp. 346-353
	Asbestos article
1951	State of Vermont enacts Workman's Compensation Law covering the disease, asbestosis
1952	Bastenier, et al. "Etude Clinique et Physiopathologique d'un cas d'asbestose pulmonaire" Archives Belges de Medicine Sociale Hygiene, Medicine du Travail et Medecine Legale, Feb. 1952. BH 27:1126
1952	Smith, A.R. "Pleural Calcification Resulting from Exposure to certain Dusts", American J. of Roentgenology, Vol. 67, 375-382
1952	Kovnatskii, M.A. et al "Silicatosis: etiology, pathogenesis, and clinical treatment." Chemical Abstracts 46:11400
1952	Luton, P., Champiex, J. and Faure, P. "A Case of Pulmonary Asbestosis with its development followed by x-ray and its post mortem study." Bulletin of Hygiene 27:942
1952	Smith, William E. "Purpose and Program of the Cancer Prevention Committee" AMA Archives of Ind. Health & Occ. Med. 5:187-189, 249-254, 262-263
1952	Clagett, O. Theron, McDonald, John R. and Schmidt, Herbert W. "Localized Fibrous Mesothelioma of the Pleura" J Thor. Surg. 24:213-230
1952	Hardy, Harriet L. "Medical Progress" N. Eng. J. Med. 247:473-483
	Article calling for more testing of cancer causing agents and cites several case reports of insulators who had asbestosis and lung cancer
1952	"List of Respiratory Protective Devices Approved by the Bureau of Mines" Circular #7636
1952	Hueper, W., Archives of Industrial Hygiene and Occupational Medicine, Vol. 5, p. 183-207 (1952)
	Article exhorting industry to concern itself with cancer risks to consumers and to general public and to seek substitutes for known cancer causing substances "Since we do not know the minimal effective dose of any of the many occupational carcinogenics, it seems obvious that they should be eliminated wherever that is practical. This can be done by using or producing suitable non-carcinogenic substitutes.
1953	Territory of Guam enacts Workmen's Compensation Law covering the disease, asbestosis
1953	Richard Bothwell v. Armstrong Cork, The Travelers Insurance Company, Massachusetts
	Asbestosis worker's compensation claim of insulator Finding of related asbestosis and lung cancer on December 8, 1953.
1953	Weiss, "Pleurakrebs bei Lungenasbestose, in vivo morphologisch gesichert", Die Medizinische (Jan. 1953) 93-94
	Pleural mesothelioma with asbestosis in an insulation worker
1953	Isselbacher, Kurt J., Klaus, Hanna, and Hardy, Harriet. "Asbestosis and Bronchogenic Carcinoma" The American Journal of Medicine 15:721-732 (Report of autopsied case and review of the available literature)
1953	Behrens, W. Jr., "The Clinical Picture and Pathology of Asbestosis" Bulletin of Hygiene 28:192
1953	Domke, F. "Lung Carcinoma caused by asbestos inhalation" Chemical Abstracts 47:4471
1953	O. Sander, Industrial Health, AMA Arch., Vol. 12, p. 288 (1953)
	Sander was a medical consultant to an asbestos manufacturing company. Medical report of asbestosis in a plumbers helper.
1953	Report of the Industrial Injuries Advisory Council, Ministry of National Insurance, pp. 22-3
1953	State of Oklahoma enacts Workmen's Compensation Law covering the disease, asbestosis
1953	Floyd Hyatt v. Armstrong Cork, Standard Insurance Florida
	Asbestosis worker's compensation claim of insulator; Letter dated February 11, 1954 from Standard Insurance to Schiedt imploring him to obtain a sample of K&M and observing that "this case has rather serious potentialities."
1953	Lewis Munger v. Armstrong Cork, Johns-Manville, The Travelers Insurance Company, Michigan
	Asbestosis worker's compensation claim of insulator; Award affirmed January 18, 1954
1954	Knox & Beattie, "Distribution of Mineral Particles and Fibers in the Lung after Exposure to Asbestos Dust", Arch. Ind. Hyg. & Occ. Med., Vol. 10, 30-36
1954	Knox & Beattie, "Mineral Content of the Lung After Exposure to Asbestos Dust", Arch. Ind. Hyg. & Occ. Med., Vol. 10, 23-29
1954	Needham, et al, "Normal Standards for Lung Volumes, Intrapulmonary Gas-Mixing, and Maximum Breathing Capacity", Thorax, Vol. 9, 313-325
1954	Cournand, et al, "The Oxygen Cost of Breathing", Trans. of Assoc. of Amer. Physicians, Vol. 67-162-173

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1956 Leicher, F. "Primärer Deckzellentumor des Bauchfells bei Asbestose" Archiv für Gewerbepathologie und Gewerbehygiene, 13:382-392

Asbestosis and peritoneal mesothelioma in an insulator

1956 Kotin, Paul. "Medical Investigation of Air Pollution" AMA Archives Industrial Hygiene and Occupational Medicine 10:288-294

1956 Wyss, V. "On the presence of asbestos fibers in the urine of asbestos workers exposed to asbestos hazard" Biological Abstracts 30-1300

1956 Ramaswamy, A.S., Venkatesh, D.S. and Rama Rao, R. "The nature of lesions caused by asbestos and mica in experimental pneumoconiosis in guinea-pigs" Bulletin of Hygiene 29:172

1956 Eckardt, Robert E. and Drinker, Philip "Editorial - AMA Arch. of Ind. Hyg. and Occ. Med. 9:449-450.

1956 Breslow et al. Am. J. of Public Health - Occupations and Cigarette Smoking as Factors in Lung Cancer - February 1954:171

1956 May 13, Letter from Luttenberger to Hugh Jackson (Johns-Manville) re release of hygiene information to public:

1. They freely share engineering techniques;
2. Dust Count Procedures - "Travelers and U.S. Govt. is working on this"
3. Medical - cooperate and give all medical information pertinent to asbestosis to an organized medical group. "We feel confident that such a medical group will not release any information that may create, in the minds of the public or of employees a feeling that the asbestos industry is a hazardous one."

1956 July 13, Letter from Luttenberger to Hugh Jackson (Johns-Manville) re: case of bronchogenic carcinoma and its relationship to asbestosis "it is very important case as far as we are concerned."

1956 Jack Cuthbertson v. Armstrong Cork, Mundet Cork, California

Asbestosis worker's compensation claim of insulator

1956 Edward Campbell v. Johns-Manville, Armstrong Cork, Mundet Cork, Keasbey & Mattison, Connecticut

Asbestosis worker's compensation claim of insulator
Letter dated October 4, 1955, from Standard Insurance Company to Armstrong Cork: "A serious claim ... asbestos."

1955 Doll, R., "Mortality from Lung Cancer in Asbestos Workers", Brit. J. of Indust. Med., Vol. 12, p. 81

A British scientists plant-wide study finding an unusually high rate of lung cancer among all asbestos workers. Records from data kept by British Government. Reported that in late 1940's a frequency of bronchogenic cancer greater than that expected on the basis of the general male population was manifest among persons who worked in the manufacture of asbestos products.

1955 Lynch, K., "Pathology of Asbestosis", AMA Arch. Indust. Health, vol. 11, 185-188.

1955 Cartier, "Some Clinical Observations of Asbestosis in Mine and Mill Workers", A.M.A. Arch. Indust. Health, Vol. 11, 204-207

Reports that 6 of 40 asbestotic mine and mill workers had lung cancer at autopsy

1955 Wright, G.W., "Functional Abnormalities of Industrial Pulmonary Fibrosis", A.M.A. Arch Indust. Health, Vol. 11, 196-203

1955 Bristol, L.J., "Roentgenologic Aspects of Silicosis", A.M.A. Arch. of Indust. Health, Vol. 11, 189-195

1955 Bastenier, et al, "Etude de la fonction respiratoire dans l'asbestose pulmonaire (I)", Arch. Mal. Prof., Vol. 16, 346-353. MH 31:344

1955 Smith, K.W., "Pulmonary Disability in Asbestos Workers", Arch. of Indust. Health, Vol. 12, 198-203

1955 Jacob & Bohlig, "Die röntgenologischen Komplikationen der Lungenasbestose" Fortschritte Geb. Rontgenstrahlen Trehlen, Vol. 83, 515-525, German. AM Rev Tuberc 73:282 (1956)

1955 Kotin, Paul and Hueper, W.C. "Relationship of Industrial Carcinogens to Cancer in the General Population" Public Health Report 70:331-333

1955 Wright, George W., and Branscomb, Ben V. "The Origin of the sensations of Dyspnea" Transactions of the American Clinical and Climatological Association" LXVI:116-125

1955 Bonser, Georgiana M., Faulds, J.S. and Stewart, M.J. "Occupational Cancer of the Urinary Bladder in Dyestuffs Operatives and the Lung of Asbestos Textile Workers and Iron-ore Miners" American Journal of Clinical Pathology 25:126-134

1955 Hueper, W.C. "Editorials-Silicosis, Asbestosis and Cancer of the Lung" American Journal of Clinical Pathology 25:1388-1390

1955 Lynch, Kenneth, M. and Pratt-Thomas, H.R. "Carcinoma of the Lung in Asbestosis: Report of Two additional cases" Southern Medical Journal 48:365-369

1955 Hueper, W.C. "A Quest Into the Environmental Causes of Cancer of the Lung" Public Health Monograph No. 36. 57 pages.

1955 Jacob, G. and Bohlig, H. "Incidence and characteristics of Lung Cancer in Asbestos Workers" Bulletin of Hygiene 30:1000

1955 Lanza, A. "Occupational Diseases of the Lungs-Recent trends in Industrial Health" AMA Archives of Industrial Health 11:183-211

1955 Pascua, M. "Increased Mortality From Cancer of the Respiratory System" Bull. World Health Organ. 12:687-704

1955 Boucot, Katharine R. and Sokoloff, Martin J. "Is Survey Cancer of the Lung Curable?" Diseases of the Chest, 13:687-704

1955 Sander, O.A. "Silicosis and Asbestosis - Diagnosis, Prevention and Treatment" Amer. J. Surg. 90:115-119

1955 McLaughlin, A.I.G. "The Dust Diseases in Great Britain" AMA Arch. of Ind. Health, 12:83-98

Acknowledges asbestosis hazard to pipecoverers

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1955 Fisher, IHF Transactions Bulletin, No. 39, pp. 13-18

Fisher, president of Johns-Manville, presentation before Industrial Health Foundation in November, 1955, comparing past "unconcern" over testing with current "insistence on every safeguard prior to marketing a product"

1955 John E. Swartout v. Armstrong Cork, Phillip Carey, Johns-Manville, Mundet Cork, California

Asbestosis worker's compensation claim of insulator
Letter and report dated August 14, 1956 from Ivan Schwab (attorney): "All the medical points to death by asbestosis." Final reconsidered award in March, 1958.

Petition, December, 1958, by Western Asbestos, seeking indemnity from Mundet Cork, Armstrong Cork, Johns-Manville and Phillip Carey. Petition granted.

1956 Frost, George & Moller, "Asbestosis with Pleural Calcification Among Insulation Workers", Danish Medical Bulletin, Vol. 3, No. 7, 202-204. Bull 449; 32:260 (1957)

Survey and study of insulators at a Danish shipyard and finds extensive asbestosis, 9 or 31 workers; This survey was annotated by the Industrial Health Foundation in June, 1957, and supplied to the leading U.S. manufacturers.

1956 Carpenter, et al, "The Relationship Between Ventilatory Capacity and Simple Pneumoconiosis in Coalworkers", Brit. J. Indust. Med., Vol. 13, 166-176

1956 Marshall & Dubois, "The Viscous Resistance of Lung Tissue in Patients with Pulmonary Disease", Clinical Science, Vol. 15, 473-483

1956 Saxton, et al, "The Relationship of Pulmonary Compliance to Pulmonary Vascular Pressures in Patients with Heart Disease", J. Clin, Invest., Vol. 35, 611-618

1956 Bader, et al, "Pulmonary Function in Asbestosis of the Lungs, 'An Alveolar-Capillary Block' Syndrome", J. Clin. Invest., Vol. 36, 871

1956 Luton, P., Champeix, et al "Observations recentes sur la Pneumoconiose par terre a diatomees", Arch. Mal. Profess., Vol. 17, 135-148, French.

1956 Trasko, Victoria, "Some Facts of the Prevalence of Silicosis in the United States", A.M.A. Archives of Ind. Health, Vol. 14, 379-386

1956 Kotin, Paul, "The Role of Atmospheric Pollution in the Pathogenesis of Pulmonary Cancer: A Review" Cancer Research 16:375-393

1956 Wright, George W. "Emphysema-Terminology and Classification" AMA Archives of Industrial Health 13:140-143

1956 Todd, Terrance C., MacDermott, R. Ernest and Mathews, William H. "Clinico-Pathological Conference, VII" The Canadian Medical Association Journal" 75:737

1956 Wiese, E. Robert and Hall, William E.B. "Asbestosis: Report of a Case" Diseases of the Chest 30:229-230

1956 Bohlig, H. and Jacob, G. "New Viewpoints on Pulmonary Cancer in Asbestos Workers" JAMA 161-916

1956 Eisenstadt, H.B. "Malignant Mesothelioma of the Pleura" Diseases of the Chest, 30:549-556

1956 Merewether, Vol. 3 Ind. Med. & Sur., p. 183-18

Textbook citing insulation work as hazardous to a small extent

1956 Hartwig v. Armstrong Cork, Wisconsin

Worker's Compensation claim for asbestosis of insulator
Letter of February 21, 1957 from Schiedt to AAA re attorney letter "In all probability the occupational disease they refer to is asbestosis which could result in a sizeable award."
Order, of January 7, 1958, approving $16,000.00 settlement without contribution by Armstrong Cork

1956 E.O. McCarroll v. Armstrong Cork, California

Worker's Compensation claim for asbestosis of insulator
Letter of March 1, 1957 from Schiedt to AAA

> "These asbestos claims are on the increase and we are wondering if the manufacturers of this high temp insulation which we use could be of some assistance in the defense of these claims."

Letter of February 25, 1957 AAA to Hughes of Armstrong Cork refers to Travelers proposal of a survey of an insulating job in their letter of February 19, 1957 from Bryant of Travelers to AAA

> "This is to advise you that our engineering department is planning to make a survey of an insulating plant in California. This way it is felt that we will then be able to develop recommendations or provide you with sufficient information so that recommendations might be developed which will prevent or minimize this exposure."

March 22, 1960, Armstrong Cork paid $13,000 in settlement.

1957 Gaffuri & Berri, "L'insufficienza Respiratoria Nell'Asbestosi", Minerva Medica, April 1957, 1639-1643

1957 Marks, et al, "Clinical Determination of the Diffusion Capacity of the Lungs", Am J. Med., Vol. 22, 51-73

1957 Marshall, R., "The Physical Properties of the Lungs in Relation to the Subdivisions of Lung Volume", Clin. Sci., Vol. 16, 507-515

1957 Fairhall, Lawrence T. "Industrial Toxicology" 2:19-21

1957 Godwin, M.C. "Diffuse Mesotheliomas - with comment on their relation to localized fibrous mesotheliomas" Cancer 10:298-319

1957 Lynch, Kenneth M., McIver, Forde A. and Cain, James R. "Pulmonary Tumors in Mice exposed to asbestos dust" AMA Archives of Industrial Health 15:207-214

1957 Thomas, D.L. Gordon. "Pneumoconiosis in Victorian Industry" The Medical Journal of Australia 1:75-77

1957 Bartorelli, E. "Severe asbestosis with Alveo-Capillary Block Syndrome" Bulletin of Hygiene 32:969

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1957 Harry Marks v. Johns-Manville, Armstrong Cork, Connecticut

Asbestosis compensation claim of insulator;
Letter of October 18, 1957, from Schiedt

> "In view of the very recent employment with Armstrong Cork, Mr. Marks must have worked extensively with other employers so that our liability in the case of an asbestos claim should be relatively small".

1957 Vincent P. Coll v. Armstrong Cork
New York

Worker's compensation cancer claim of an insulator

Decision of Workmen's Compensation Board dated July 30, 1957, granted benefits against Armstrong Cork.
Medical record in file indicates cancer.

1957 Fred E. Strickland v. Armstrong Cork, Fiberglass Engineering, Owens-Corning
California

Letter of August 21, 1958 refers to claim as being one for asbestosis.
Worker's Compensation claim of an insulator.

1957 James W. Riley v. Armstrong Cork, Phillip Carey, Owens-Corning, Johns-Manville
California

Worker's Compensation claim for asbestosis of an insulator.
Award of November 27, 1959 against Johns-Manville and Armstrong Cork;
Petition for reapportionment filed on November, 1960, against Fibreboard, Paraffine, Owens-Corning, Armstrong Cork, Phillip Carey, United Refractory.

1958 Pendergrass, "Silicosis and a Few of the Other Pneumoconioses: Observations on Certain Aspects of the Problem, With Emphasis on the Role of the Radiologist", Amer. J. of Roentgenol., Vol. 80, (July 1958), 1-41

1958 Industrial Hygiene Journal, "Asbestosis", Vol. 19, No. 1 April 1958, 161-163

1958 Sharp, et al. "Ventilatory Mechanics in Pulmonary Edema in Man" J/ Clin. Invest., Vol. 37, 111-117

1958 Amsler, "L'Asbestose Pulmonaire", Rev.Prat., (Paris), Vol. 8, 1193-1205

1958 McCaughey, W.T.E. "Primary Tumors of the Pleura" Journal of Pathology and Bacteriology 76:517-529

1958 Richards, Anthony G. and Barrett, Geoffrey M. "Rheumatoid Lung Changes associated with Asbestosis" Thorax 13:185-193. BH 34:33 (1958)

1958 Van Der Schoot, H.C.M. "Asbestosis en Pleuragezwellen" Ned. T. Geneesk 102:125-126

1958 Braun, D.C. and T.D. Truan, "An Epidemiological Study of Lung Cancer in Asbestos Miners," Archives of Industrial Health, 1958, p. 634

Large study by Industrial Health Foundation, supported by United States Industry. (Good for industry but only thirty (30%) percent of workers had been employed for twenty or more years. These men were aware of twenty year latent period but ignored it in reports.)

1958 Robert Zini v. Armstrong Cork
California

Worker's Compensation claim for asbestosis of an insulator; claim denied July 1, 1960;

Dr. Campagna testifies: relates death to cancer suggestible relationship between asbestos and cancer. Cancer is compensable in Germany.

Letter, August 25, 1959, from Schiedt to Taylor of Armstrong Contracting & Supply:

> "Apparently the California Industrial Commission accepts the fact that asbestos is contracted by pipe covering mechanics although we have had very few awards in other states due to asbestos."

1958 James Shepherd v. Armstrong Cork
Massachusetts

Worker's Compensation claim for asbestosis and cancer of an insulator; Shepherd was a plasterer on loan as a pipe coverer. Says claimant only worked for seven (7) weeks.

February 19, 1960 memo with copy to Liddell imploring them to begin chest x-ray so as to avoid claims like this.

Case settled by Armstrong Cork for $3,000.00.

1958 Thomas B. Spencer v. Armstrong Cork
Pennsylvania

Worker's Compensation claim of an insulator for asbestosis

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1959 Bertz & Reimwein, "Asbestose bei Isolierern", Arztliche Wochenschrift, Vol. 14, 361-365. ("Asbestosis among Insulation Workers")

Medical report of asbestosis and cancer in insulators.

1959 Donovan, et al, "Influence of Age on Pulmonary Diffusing Capacity", J. of Applied Physiology, Vol. 14, 483-492.

1959 Thomas, M., Falk, Hans L., and Kotin, Paul. "Effect of pollutants on Ciliated Mucus-secreting Epithelium" Journal National Cancer Institute 23:979-97

1959 Threshold Limit Values - Archives of Industrial Health 70:264-270

1959 Kotin, Paul. "Exogenous and Endogenous Factors in the Pathogenesis of Lung Cancer" ACTA 15:613-618

1959 Kotin, Paul. "Single Injury and Cancer" California Medicine 91:150

1958 Leathart, G.L. "The mechanical properties of the lung in pneumoconiosis of coal miners" British Journal of Industrial Medicine 16:153-165

1959 Nordvik, H. "Are Silicosis and Asbestosis predisposing Causes of Cancer of the Lung" Bulletin of Hygiene 34:1020

1959 Bohlig, H., Jacob, G. and Kallabis, H. "Morbidity and Pathology of Lung Cancer with Asbestosis" Bulletin of Hygiene 34:1020-1021

1959 Letter from Dr. K.W. Smith, Medical Director of Johns-Manville to G.H. Brewer, Johns-Manville, Pittsburgh, California

Dr. Smith told them that of thirty long service employees whose medical files were reviewed, twenty-one showed positive evidence of pulmonary disease. He urged the removal of all atmospheric dust contamination.

1959 Clarence Reed v. Armstrong Cork
Texas

Insulator death alleged due to asbestos; June 7, 1960, Armstrong Cork paid $1,500.00

1959 Roy Thorsted v. Armstrong Cork
California

Worker's Compensation claim of insulator alleging asbestosis
Letter of March 17, 1960 from Schiedt to Edgar:

> "as you know these pneumoconiosis and asbestos claims are on the increase in many sections of the country."

Referee's decision of December 30, 1959; no asbestosis

1959 Robert F. Cuthbertson v. Armstrong Cork
California

Worker's Compensation claim of insulator for asbestosis

Letter of July 29, 1959 from Schiedt to Hanna & Brophy (attorneys):

> "We know your attorneys both in your San Francisco and Oakland offices have had considerable experience handling asbestos claims."

August 13, 1959, claim was dismissed for lack of diagnosis.

1959 Thomas Maggie Bond-Washington filed against multiple defendants in Washington State. Worker's Compensation claim for asbestosis of an insulator

1959 Lloyd U. Viall v. Armstrong Cork
Nevada

Worker's Compensation claim for asbestosis of an insulator
Letter of August 5, 1959 from Schiedt to J.S. Taylor of Armstrong Contracting and Supply:

> "If the number of lung claims keep on increasing as they have in the past several weeks, most of your time will be spent on asbestosis and pneumoconiosis claims. Seriously, though, it is important that we cooperate with our insurance carriers and give them all the help we can for two reasons. First, these claims usually result in total permanent disability which means maximum compensation awards of which we will pay our proportionate share. Second, there is some doubt that our type of work could cause asbestosis. However, since one employee collected under the California Occupational Disease Law, we have had quite a few asbestosis claims.
>
> Very truly yours,
>
> ARMSTRONG CORK COMPANY
>
> R.C. Schiedt, Jr.
> Insurance Department"

1960 "Silicosis and Pneumoconioses in Sweden", Chapter 1, Asbestosis, 353-357

1960 Kiviluoto, "Pleural Calcification as a Roentgenologic Sign of Non-Occupational Endemic Anthophyllite-Asbestosis", Acta Radiologia (Sweden) 7-67

1960 Wagner, J.C., C.A. Sleggs and Paul Marchand, "Diffuse Pleural Mesothelioma and Asbestos Exposure in the North Western Cape Province", Brit. J. Indust. Med., Vol. 17, 260-271

Reported an unusually frequent number of cases of mesothelioma among residents of a community surrounding an asbestos mine.

1960 Beattie & Knox, "Studies of Mineral Content and Particle Size Distribution in the Lungs of Asbestos Textile Workers" Inhaled Particles and Vapours, (Symposium Report), 419-433

1960 Leathart, "Clinical, Bronchographic, Radiological and Physiological Observations in Ten Cases of Asbestosis", Brit. J. Med., Vol. 17, 213-227

1960 Keal, E.E. "Asbestosis and Abdominal Neoplasms" Lancet 2:1211-1216. Can. Med. Assn J. 86:16 (1961)

1960 Anderson, John and Campagna, Francis A. "Asbestosis and Carcinoma of the Lung" Archives of Environmental Health 1:27-32

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1960 Beattie, J. "The Asbestosis Body" Inhaled Particles and Vapours 434-442

1960 Clinico-pathological Conference—"Complications of Asbestosis" British Medical Journal 4/2/60, pp1345-1353

1960 Abstract article 60-9 appearing in Bulletin of Hygiene 35:662

1960 Yoshikawa, M. "Experimental Asbestosis in Guinea Pigs and Rats" Bulletin of Hygiene 35:862

1960 Winslow, Donald J. and Taylor, Herbert B. "Malignant Peritoneal Mesotheliomas" Cancer 13:127-136

1960 Clinicopathologic Conference. U.S. Armed Forces Med. J. 11:303-316

1960 Eisenstadt, HB and Wilson, F.W. "Primary Malignant Mesothelioma of the Pleura" The Journal Lancet 80:511-514

1960 Konig, J. "Uber die Asbestose". Archiv fur Gewerbepathologie und Gewerbehygiene 18:159-206

1960 Nordmann, Martin and Sonnenhart, Hermann "Asbest-Zementstaub-Lunge" Archiv fur Gewerbepathologie und Gewerbehygiene, 18:203-219

1960 Ahlmark, Survey of insulator disease in Sweden

Reports nineteen cases of asbestosis, nearly all laggers

1960 Anderson and Campagna, Archives of Environmental Health, Vol. 1. 38

Report on asbestosis and lung cancer in insulators

1960 Minutes of National Insulation Manufacturers Association, January 13, 1960

Proposed to industry that an asbestos health program be implemented. The proposal was turned down at the May 6, 1960, meeting.

1960 William Dean v. Armstrong Cork
New York

Worker's Compensation claim for death of insulator caused by asbestos.

Letter dated February 10, 1961, from Scheidt to Hefferth (AAA): "Our file indicates that Dean's death December 6, 1959 was caused by asbestos."

1960 Clifford F. Harding v. Armstrong Cork and Owens-Corning Fiberglas, California

Worker's Compensation claim for asbestosis of an insulator
September 29, 1961 claim was settled
Order and Report of Referee dated September 26, 1961, approving settlement including contribution from Aetna (for Owens-Corning) and Armstrong Cork, reciting medical reports of mild asbestosis and non-connected heart disease. Report from Hinshaw confirms mild asbestosis on May 17, 1961

1960 L.J. Streithorst v. Armstrong Cork and Mundet Cork, Fiberglas Engineering and Supply (Owens-Corning) Mundet Cork, Pariffine Company (Fibreboard)
Worker's Compensation claim of an insulator for asbestosis in California

Medical reports of Dr. Hinshaw, 1960 and 1962, indicate pleural changes consistent with asbestosis but non-disabling.

1960 Harvey Curtis v. Armstrong Cork and Owens-Corning
Michigan

Worker's Compensation claim of an insulator for asbestosis

1961 Bader, Bader & Selikoff, "Pulmonary Function in Asbestosis of the Lungs", Amer. J. Med., Vol. 30, 235-242

1961 Mitchell, Jerry. "Health Progress in an Asbestos Textile Works" Archives of Environmental Health 3:37-41

1961 Telischi, M. and Rubenstone, A.I. "Pulmonary Asbestosis-associated with Primary Carcinoma of the Lung, Bronchial Adenoma and Adenocarcinoma of the Stomach" Archives of Pathology 72:116-125

Case Report of asbestosis and lung cancer in a plaster mixer; material contained some percentage of asbestos

1961 Sleggs, C.A., Marchand, Paul and Wagner, J.C. "Diffuse Pleural Mesotheliomas in South Africa" South African Medical Journal 35:28-34. APCA Abst 8:7 (1962)

1961 Epidemiologic follow-up to Wagner. Includes insulators and finds mesothelioma

1961 Hurwitz, M. "Roentgenologic Aspects of Asbestosis" The American Journal of Roentgenology Radium Therapy and Nuclear Medicine 85:256-262. AM Rev RESP Dis 84:629

1961 Heard, Brian E. and Williams, Roger "The Pathology of Asbestosis with Reference to Lung Function" Thorax 16:264-281

1961 Clark, S.G. and Holt, P.F. "Studies on the Chemical Properties of Chrysotile in Relation to Asbestosis" The Annals of Occupational Hygiene 3:22-29. BH 36:636 (1961)

1961 Brugsch, Heinrich G. and Bavley, Harold. "Asbestosis in a Worker engaged in Automobile Undercoating" The New England Journal of Medicine, 265:379-381

Report of asbestosis in an automobile undercoater

1961 Jacobs, G. and Dahlig, B. "The Changes in the Bronchial Tree in Asbestosis" Bulletin of Hygiene 36:636

1961 Sano, H. "Studies on the Asbestosis Body" Bulletin of Hygiene 36:635

1961 Castleman, Benjamin and Kibbee, Betty U. "Case Records of the Massachusetts General Hospital" New England J. of Med. 265:745-751

1961 Rubin and Rubin: Textbook on Thoracic Diseases W.B. Saunders & Company

Emphasizes cardiopulmonary relationships; Textbook describing risk of asbestos and lung cancer in insulators

1961 Steve Gillvich v. Plant Rubber & Asbestos, Mundet Cork, Paraffine (Fibreboard), Armstrong Cork, Owens-Corning, Phillip Carey
California
Worker's Compensation Claim of an insulator for asbestosis
Claim settled December 22, 1964, for a total of $7,968.00

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1961	John B. Gruenthal v. Armstrong Cork and Armstrong Contracting and Supply Washington
	Worker's Compensation claim of an insulator for asbestosis; Appellate order of November, 1962, discussing causal connection with asbestos and cancer.
1962	McCaughey, Wade & Elmes, "Exposure to Asbestos Dust and Diffuse Pleural Mesotheliomas", Brit. Med. J., Nov. 24, 1962, 1397
1962	Ellson & Wagner, "Mesotheliomas and Asbestos Dust", Brit. Med. J. Nov. 3, 1962, 1194-1195
1962	Leathart & Sanderson, "Some Observations on Asbestosis", Annals of Occup. Hygiene, Vol. 6, 65-74
1962	Falk, Hans L., Kotin, Paul "An Assessment of Factors Concerned with the Carcinogenic Properties of Air Pollutants" National Cancer Institute Monograph 9:81-89
1962	Smither, 2 Brit. Med. J., P. 1194 (1962)
	Asbestosis and mesothelioma in an insulator
1962	Thomson, J.G. "Mesothelioma of Pleura or Peritoneum and Limited Basal Asbestosis" South African Medical Journal 36:759-760
1962	Thomson, J.G., Kaschula, R.O.C. and MacDonald, R.R. "Asbestos as a Modern Urban Hazard" South African Medical Journal 37:77-81
1962	Horai, Z. et al "Studies on the Course of Asbestosis Patients" Japanese Journal of Medicine 1:157-158
1962	Cordova, Juan F., Tesluk, Henry and Knudtson, Kenneth. "Asbestosis and Carcinoma of the Lung" Cancer 15:1181-1187. JAMA 182:329
	Survey and study of cases including insulators finding asbestosis and lung cancer
1962	Demy, Nicholas G. "Pulmonary (lung) Asbestosis: A Radiologist's Views" Medical Trial Technique Quarterly 131-138
1962	Cartier, Paul and Cross, Paul. "Nonoccupational Diffuse Pulmonary Fibrosis-A Report of a case of an Asbestos Worker" Archives of Environmental Health 4:73-80. JAMA 179:307
1962	Bohlig, H., Jacob, G. and Muller, H. "The Constitutional Factor in Asbestosis" Bulletin of Hygiene 37:460-461
1962	Spencer, H. "Asbestosis" Pathology of the Lung 341-345, 610-619
1962	Postman, Benjamin F. "Dust Control in the Asbestos Textile Industry American Industrial Hygiene Association Journal 23:67-74
1962	Eisenstadt, H.B. "Pleural Asbestosis" American Practitioner 13:573-7. JAMA 182:203
	Asbestosis and mesothelioma in three oil refinery workers who worked with insulation
1962	An, Sang Hi and Koprowska, Irena "Primary Cytologic Diagnosis of Asbestosis Associated with Bronchogenic Carcinoma" Acta Cytology 6:391-398
1962	Hervieux, J., Certains aspects de l'asbestose. Cah. Med. Interprof. 2:41-8 (1962)
	Asbestosis in an insulator
1962	Hueper, 3 Clinical Pharmacology and Therapeutics, p. 776
	Survey of world literature and reports of asbestosis and lung cancer in insulators
1962	McCaughey, 2 Brit. Medical Journal, p. 1397
	Asbestosis and mesothelioma in an insulator
1962	Schepers, chapter on occupational chest diseases from Fleming, D'Alonzo and Zapp, Modern Occupational Medicine (1962)
	Textbook describing disease in persons whose only exposure was during World War II working on "Liberty Ships"
1962	Spencer, Pathology of the Lung (1962)
	In textbook states it is well recognized that asbestosis occurs in all who handle the mineral
1962	Preliminary Industrial Hygiene Survey of the Philip Carey Mfg. Co., (December, 1962)
	Plant was called very dusty
1962	John Wyss v. Armstrong Cork, Owens-Corning, Mundet Cork California
	Worker's Compensation claim of an insulator for asbestosis Case settled for $6,300.00 in April, 1966
1962	Paul J. Greischar v. Owens-Corning, Armstrong Cork, Johns-Manville California
	Worker's Compensation claim of an insulator for asbestosis Claim settled in April, 1966 Medical reports in file dating to 1962 indicate asbestosis
1962	Irene Brodale v. Armstrong Cork California
	Worker's Compensation claim for death of an insulator from cancer and asbestosis
1962	Anthony Onofrio v. Armstrong Cork, Philip Carey, Johns-Manville Connecticut
	Worker's Compensation claim of an insulator for asbestosis
1962	Arthur Miller v. Armstrong Cork, Mundet Cork, Fibreboard Corporation California
	Worker's Compensation claim of an insulator for asbestosis

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1962 George A. Kingston v. Armstrong Cork
Minnesota

Worker's Compensation claim of an insulator for asbestosis
Letter of October 29, 1962, acknowledging receipt of claim for asbestosis as result of working for numerous contractors
Settlement of $13,500 dated March 27, 1963

1963 John D. Staples v. Armstrong Cork
California

Worker's Compensation claim of an insulator for asbestosis

1963 Thomson, "Exposure to Asbestos Dust and Diffuse Pleural Mesotheliomas", Brit. Med. J. (Jan. 12, 1963) p. 123

1963 Mancuso & Coulter, "Methodology in Industrial Health Studies", Archives of Environmental Health, Vol. 6, 36-52

1963 Falk, Hans L., Kotin, Paul and Rowlette, Winifred "The Response of Mucus Secreting Epithelium and Mucus to Irritants" Annals New York Academy of Sciences 106:583-608

1963 Wagner, J.C., "Asbestosis in Experimental Animals" British Journal of Industrial Medicine 20:1-12

1963 Webster, I. "Asbestosis in non-experimental animals in South Africa. Nature 197:506. BA 38:650

1963 Thomson, J.G., Kaschula, R.O.C. and MacDonald, R.R. "Asbestos as a Modern Urban Hazard" South African Medical Journal 37:77-81

1963 Leathart, G.L. and Sanderson, J.T. "Some observations on Asbestosis" The Annals of Occupational Hygiene 6:65-74. BA 38:1162

1963 Sluis-Cremer, G.K. and Wagner, J.C. "A Pathological-Radiological Correlation in 108 Cases of Asbestosis proved at Post-Mortem" XIVth International Congress of Occupational Health 3:608-610

1963 Gross, Paul "Chronic Pneumonitis and Asbestosis" British Medical Journal 11:1130-31

1963 Editorial: Pulmonary Asbestosis South African Medical Journal 37:629-630

1963 Castleman, Benjamin and Kibbee, Betty U. "Case Records of the Massachusetts General Hospital: N. Eng. Jo Med. 269:767-794

1963 Auerbach, Oscar; Stout, AP; Hammond, Cuyler E. and Garfinkel, Lawrence "Smoking Habits and Age in Relation to Pulmonary Changes" Ibid, 269:1045-1054

1963 Lanza, A.J. "The Pneumoconioses". Grune & Stratton, New York.

1963 Selikoff, et al., Asbestos Exposure and Neoplasia, JAMA, 188:142

Initial paper presented an epidemiologic survey of insulation workers discovering asbestosis, lung cancer and mesothelioma

1963 Engineering Equipment Users Association Handbook N. 12, "Thermal Insulation of Pipes and Vessels", Constable & Co., London, 1963. Part 2, page 31 states:

> Inhaled dust from certain insulating materials, notably diatomite and asbestos, can cause pneumoconiosis, though the risk is small if cutting operations are performed out-of-doors. Dust forming operations should not however be carried out in badly ventilated situations.

1963 June 6, Minutes of Air Hygiene & Manufacturing Committee, Asbestos Textile Institute, Inc.:

> "The committee was advised that a Dr. Selichoff (Selikoff) will read at the next meeting of the American Medical Association in about 30 days a paper one study he has made of about 1500 workers, largely in asbestos insulation applications, showing a very large incidence of lung cancer over normal expectancy."
>
> "How scientific this study has been in selecting the group and the full depth of the study remains to be determined, but admittedly it will be damaging to the industry."

1963 May 23, Letter from Dr. Thomas Mancuso to L.J. Knippe, Phillip Carey Mfg. Co., plant manager:

Dr. Mancuso advised company to initiate a program to advise consumers of the risks of use of asbestos containing products

1963 August 13, Letter of Dr. Thomas Mancuso to L.J. Knippe, Phillip Carey Mfg. Co., plant manager:

Forwards copies of Dr. Selikoff's 1936 epidemiologic study of May, 1963, to company and advises them of their own personal liability for failure to provide insulators a safe place to work. (In September, 1963, Phillip Carey declined to renew Dr. Mancuso's contract.)

1963 July 22, Letter of Zimmerman (Raybestos-Manhattan) to Dr. Gralley (NDPHS)

Doesn't want to agree to go along with medical part of survey for fear of alarming the employees

1963 Robert O. Green v. Mundet Cork, Johns-Manville, Armstrong Cork and Armstrong Contracting and Supply, Owens-Corning Fiberglas
California

Worker's Compensation claim of an insulator for asbestosis
Letter of January 16, 1964 from Charles W. McMillan, attorney to Industrial Commission of California and copy to all defendants re: medical report of Dr. Hinshaw dated October 16, 1960, diagnosing Green as having asbestosis and listing him as an insulator.

1963 Gus Addison v. Plant Rubber and Asbestos, Armstrong Cork and Johns-Manville
California

Worker's Compensation claim of an insulator for asbestosis
Settled on April 30, 1965

1963 Allen Everett v. Armstrong Cork, Phillip Carey, Fibreboard Corporation, Mundet Cork, Owens-Corning
California

Worker's Compensation claim of insulator for asbestosis
Letter dated May 4, 1964 from Schwab (attorney) to Armstrong Contracting & Supply:

> "We know from experience gained from trying other asbestos claims that magnesia pipe covering does contain asbestos and that it has to be cut and the use does create some dust."

1963 Edward Marsh v. Armstrong Cork, Fibreboard Corp.
California

Worker's Compensation claim for asbestosis of insulator

1964 Selikoff, Churg & Hammond, "Asbestos Exposure and Neoplasia", JAMA, Vol. 188, (April 6, 1964), 22-26 (142-146).

1964 Marr, Asbestos Exposure During Naval Vessel Overhaul", Amer. Indust. Hyg. J., Vol. 25, 264-268

Epidemiologic studies showing asbestosis, lung cancer and mesothelioma

1964 Enticknap & Smither, "Peritoneal Tumours in Asbestosis", Brit. J. of Industrial Med, Vol. 21, 20-31

Epidemiologic studies showing asbestosis, lung cancer and mesothelioma

1964 Hourihane, Dermot O'B. 'The Pathology of Mesotheliomata and an analysis of their association with asbestos exposure" Thorax 19:268-278. Am Rev. Resp. Dis. 9:665

1964 Elwood, P.C. and Cochrane, A.L. "A Follow-up Study of Workers from an Asbestos Factory" British Journal of Industrial Medicine 21:304-307

1964 Kotin, Paul "Environmental Diseases-A Pathologist's Overview and Public Health Responsibility" American Journal of Pathology 44:223-236

1964 Editorial "Dangerous Dust?" Scientific American 211:64

1964 Morgan, W.K.C. "Rheumatoid pneumoconiosis in association with asbestosis" Thorax 19:433-435

1964 Owen, W. Glyn. "Diffuse Mesothelioma and exposure to Asbestos Dust in the Merseyside area: British Medical Journal 2:214-218

1964 Dyson, Burton C. and Trentalance, Alberto E. "Resection of Primary Pulmonary Sarcoma - Review of literature and report of a case associated with pulmonary asbestosis" The Journal of Thoracic and Cardiovascular Surgery 47:577-589

1964 Bjure, J., Soderholm, B and Widimsky, J. "Cardiopulmonary function studies in workers dealing with asbestos and glasswool" Thorax 19:22-27. Pub Health Eng. Abst. 45:53

1964 Editorial "Asbestos and Malignancy" British Medical Journal 2:383-383

1964 Smith, W.E., Miller, L., Churg, J and Selikoff. "Pleural Reaction and Mesothelioma in Hamsters injected with Asbestos" Proceedings of the American Association for Cancer Research 5:59

1964 "Report and Recommendations of the Working Group on Asbestos and Cancer" British Journal of Industrial Medicine 22:165-171

1964 Andrews, G.S. and Roeser, T. "Clinical Value of Exfoliative Cytology in Neoplasia of the Lung" Thorax 19:279-286

1964 McVittie, New York Acd. Sci.

Retrospective study (1955-63) of insulators who filed for Workmen's Compensation showing large number of claims from asbestosis

1965a Dunn & Weir, "Cancer Experience of Several Occupational Groups Followed Prospectively", Amer. J. of Public Health, Vol. 55, No. 9, 1367-1375

1965b Selikoff, Churg & Hammond, "Relation Between Exposure to Asbestos and Mesothelioma", N.E.J. Med., Vol. 272, 560-565. J. Occ Med 7:548

1965c Newhouse & Thompson, "Mesothelioma of Pleura and Peritoneum Following Exposure to Asbestos in the London Area", Brit. J. Ind. Med., Vol. 22, 261-269

1965d "The Industrial Environment...its Evaluation and Control" Public Health Service

1965e Hinson, K.F.W., "Cancer of the Lungs and Other Diseases After Exposure to Asbestos Dust" British Journal of Diseases of the Chest 59:121-129. APCA 12:6 (1966)

1965f Kotin, Paul. Archives of Pathology 79:331-334

1965g News article - Cleveland Plain Dealer Jan. 13, 1965

1965h Williams, W. James. "Asbestos and Lung Cancer" Archives of Environmental Health 10:44-45

1965i Steel, S.J. and Boyd, J. "Pleural Calcification and Mesothelioma Following exposure to Asbestos" British Journal of Diseases of the Chest" 59:130-133

1965j Smith, W.E. and Elsasser, E. "A Transplantable Mesothelioma Induced by Asbestos" Federation Proceedings 24:530

1965k Hardy, Harriet, L. "Asbestos Related Disease" The American Journal of the Medical Sciences 250:49-57. APCA 12:6 (1966)

1965l Elmes, P.C., McCaughey, W.T.E. and Wade, O.L. "Diffuse Mesothelioma of the Pleura and Asbestos" British Medical Journal 1:350-353. J. OCC MED 7:541

1965m Editorial - Special Report - "Asbestos and Cancer" The Canadian Medical Association Journal 93:1020-1023

1965n Westlake et al. "Penetration of Colonic Mucosa by Asbestos Particles" Laboratory Investigation 14:2029-2033

* ALL OF THE FOLLOWING ARE FOUND IN VOL 132 ART 1 ANNALS OF THE NY ACAD. SCIENCES 1965

1965 Hendry, "The Geology, Occurrences, and Major Uses of Asbestos", pp. 12-22

1965 Gaze, R., "The Physical and Molecular Structure of Asbestos', pp. 23-30

*1965 Harington, "Chemical Studies of Asbestos", pp. 31-47. APCA 12:3 (1966)

1965 Berkley, Churg, Selikoff & Smith, "The Detection and Localization of Mineral Fibers in Tissue", pp. 48-63

*1965 Nagelschmidt, "Some Observations of the Dust Content and Composition in Lungs with Asbestosis, Made During Work on Coal Miners Pneumoconiosis", pp. 64-75. APCA 12:7 (1966)

© 1979 Andrews Publications, Inc., All Rights Reserved

Reproduction in whole or part strictly prohibited.

*1965 Wagner & Skidmore, "Asbestos Dust Deposition and Retention in Rats", pp. 77-86. APCA 12:6 (1966)

*1965 Holt, Mills & Young, "Experimental Asbestosis With Four Types of Fibers: Importance of Small Particles", pp. 87-97. APCA 12:6 (1966)

1965 Davis, J.M.G., "Electron-Microscope Studies of Asbestosis in Man and Animals", pp. 98-111

1965 Pernis, Vigliani & Selikoff, "Rheumatoid Factor in Serum of Individuals Exposed to Asbestos", pp. 112-120. Discussion, pp. 121-127

1965 McVittie, "Asbestosis in Great Britain, pp. 128-138

1965 Selikoff, Churg & Hammond, "The Occurrence of Asbestosis Among Insulation Workers in the United States", 139-155

1965 Enterline, P.E., "Mortality Among Asbestos Products Workers in the United States", pp. 156-165

1965 Smither, W.J., "Secular Changes in Asbestosis in an Asbestos Factory", pp. 166-181. Discussion, pp. 181-183

1965 Hueper, W.C., "Occupational and Nonoccupational Exposure to Asbestos", pp. 184-195. APCA 11:6 (1966)

1965 Thomson, J.G., "Asbestos and the Urban Dweller" pp. 196-214. APCA 11:3 (1966)

1965 Sluis-Cremer, G.K., "Asbestosis in South Africa—Certain Geographical and Environmental Considerations", 215-234

1965 Hunt, R., Routine Lung Function Studies on 830 Employees in an Asbestos Processing Factory", pp. 406-420

1965 Thomson, Pelzer & Smither, "The Discriminant Value of Pulmonary Function Tests in Asbestos", pp. 421-436. Discussion, pp. 437-438

1965 Harington & Roe, "Studies of Carcinogenesis of Asbestos Fibers and Their Natural Oils", pp. 439-450

1965 Badollet & Gantt, "Preparation of Asbestos Fibers for Experimental Use", pp. 451-455

1965 Smith, Miller, Elsasser & Hubert, "Tests for Carcinogenicity of Asbestos", 456-488

*1965 Miller, Smith & Berliner, "Tests for Effect of Asbestos on Benzo(a)Pyrene Carcinogenesis in the Respiratory Tract", pp. 489-500. APCA 12:6 (1966)

*1965 Peacock & Peacock, "Asbestos-Induced Tumors in White Leghorn Fowls", pp. 501-503. Discussion, pp. 504-506. APCA11:7 (1966)

1965 Buchanan, W.D., "Asbestosis and Primary Intrathoracic Neoplasms", 507-518

*1965 Hammond, Selikoff & Churg, "Neoplasia Among Insulation Workers in the United States with Special Reference to Intra-Abdominal Neoplasia", 519-525. APCA 11:6 (1966)

1965 Knox, Doll & Hill, "Cohort Analysis of Changes in Incidence of Bronchial Carcinoma in a Textile Asbestos Factory", 526-535

1965 Jacob & Anspach, "Pulmonary Neoplasia Among Dresden Asbestos Workers", 536-548

1965 Elmes & Wade, "Relationship Between Exposure to Asbestos and Pleural Malignancy in Belfast", 549-557

1965 Vigliani, Mottura & Maranzana, "Association of Pulmonary Tumors with Asbestosis in Piedmont and Lombardy", 558-574

1965 Wagner, J.C., "Epidemiology of Diffuse Mesothelial Tumors: Evidence of an Association from Studies in South Africa and the United Kingdom", 575-578

1965 Newhouse & Thompson, "Epidemiology of Mesothelial Tumors in the London Area", 579-588. Discussion, 589-602

1965 McCaughey, W.T.E., "Criteria for Diagnosis of Diffuse Mesothelial Tumors", 603-613

1965 Churg, Rosen & Moolten, "Histological Characteristics of Mesothelioma Associated with Asbestos", 614-622

1965 Webster, I., "Mesotheliomatous Tumors in South Africa: Pathology and Experimental Pathology, 623-646

1965 Hourihane, D., "A Biopsy Series of Mesotheliomata, And Attempts to Identify Asbestos Within Some of the Tumors", 647-673.

1965 Owen, W.G., "Mesothelial Tumors and Exposure to Asbestos Dust", 674-679, Discussion, 680-684

1965 Smith, K.W., "Trends in the Health of the Asbestos Workers", 685-690

*1965 Wagner, J.C., "The Sequelae of Exposure to Asbestos Dust", 691-695. APCA 12:2 (1966)

1965 Gilson, J.C., "Problems and Perspectives: The Changing Hazard of Exposure to Asbestos", 696-705

1966 Ahlman, "Asbestosis Among Insulating Workers in Finland", Hygiene Toxicology Occupational Diseases - Seminar Vienna, 237-240

*1966 Keane & Zavon, "Occupational Hazards of Pipe Insulators", Arch. Environ. Health, Vol. 13, 171-184

1966 Medical Series Bulletin #11, "Asbestos Bioeffects Research for Industry", Indust. Hygiene Foundation of America, Inc. 18 pages

*1966 O'Donnell, Mann & Grosh, "Asbestos, an Extrinsic Factor in the Pathogenesis of Bronchogenic Carcinoma and Mesothelioma", Cancer a Journal of the Amer. Cancer Society, Vol. 19, 1143-1148

1966 Kotin, Paul, Courington, Doris and Falk, Hans L. "Pathogenesis of Cancer in a Ciliated Mucus Secreting Epithelium" American Review Respiratory Diseases 93:115-133

1966 Wright, George W. "Effects of Industrial Dust on Ciliated Epithelium" The American Review of Respiratory Diseases 93:103-107

©1979 Andrews Publications, Inc., All Rights Reserved Reproduction in whole or part strictly prohibited.

1966 Gaensler, Edward A., and Wright, George W. "Evaluation of Respiratory Impairment" Archives of Environmental Health 93:103-107

*1966 Kleinfeld, M., Messite, J. and Shapiro, J. "Clinical, Radiological and Physiological Findings in Asbestosis" Archives of Internal Medicine 117:813-819

1966 Kleinfeld, Morris, Messite, J., Kooyman, O. and Sarfaty, J. "Effect of Asbestos Dust Inhalation on Lung Function" Archives of Environmental Health 12:741-746

*1966 Editorial - Lancet 1:330-331 "Health Hazards of Asbestos". Pub Health Eng Abst. 46:239 (1966)

*1966 Lieben, Jan. "Malignancies in Asbestos Workers" Archives of Environmental Health 13:619-621

*1966 Editorial "Exposure to Asbestos and Malignancy" The London Clinic Quarterly 7:10-11. APCA 12:7 (1966)

*1966 Hourihane, D.O., Lessof. L., and Richardson, P.C. "Hyaline and Calcified Pleural Plaques as an index to exposure to Asbestos - A Study of Radiological and Pathological features of 100 cases with a consideration of Epidemiology" British Medical Journal 1:1069-1074. APCA 12:3 (1966)

*1966 Elmes, P.C. "The Epidemiology and Clinical Features of Asbestosis and Related Diseases" Post Graduate Medical Journal 42:623-635. APCA 13:7 (1966)

*1967 Selikoff, Bader, Bader, Churg & Hammond, "Asbestosis and Neoplasia", Amer. J. of Med., Vol 42, 487-496. APCA 18:10 (1967)

*1967 Borow, Conston, Livornese & Schalet, "Mesothelioma and Its Association with Asbestosis", JAMA, Vol. 201, No. 8, 8/21/67, 93-97 (587-591). AM Rev Resp Dis 97:748 (1968)

1967 Graham, John, and Graham, Ruth, "Ovarian Cancer and Asbestos" Environmental Research 1:115-128

*1967 Enterline, Philip E. and Kendrick, Mildred A. "Asbestos-dust Exposures at Various Levels and Mortality" Archives of Environmental Health 15:181-186

*1967 Cralley, L.J., Keenan, R.G. and Lynch, J.R. "Exposure to Metals in the Manufacture of Asbestos Textile Products" American Industrial Hygiene Association Journal 28:452-462

*1967 Cooper, W. Clark, "Asbestos as a Hazard to Health" Archives of Environmental Health 15:285-290

*1967 Mancuso, T. and El-Attar, Anas A. "Mortality Pattern in a Cohort of Asbestos Workers" Journ-l of Occupational Medicine 9:147-162

*1967 Gross, Paul and deTreville, Robert T.P. "Experimental Asbestosis" Archives of Environmental Health 15:638-649

1967 Sluis-Cremer, G.K. and Webster, I. "Asbestos-The Lethal Dust" South African Medical Journal 41:1206

1967 Ratzer, E.R., Pool, John L. and Melamed, Myron R. "Pleural Mesotheliomas" The American Journal of Roentgenology Radium Therapy and Nuclear Medicine 99:863-880

*1967 Bump, Nicholas, G. and Adler, Howard "Asbestosis and Malignancy" The American Journal of Roentgenology Radium Therapy and Nuclear Medicine 100:397-402. JAMA 201:171 (1967)

*1967 Gross, Paul, deTreville, Robert T.P., Tolker, Ethel B. Kaschak, Marianne and Babyak, Mary Ann. "Experimental Asbestosis" Archives of Environmental Health 15:343-355

*1967 Freundlich, Irwin M. and Greening, Roy R. "Asbestosis and Associated Medical Problems" Radiology 89:224-229. Public Health E.A. 47:374

*1967 Harwood, W.B., Pagan, P.A. and Mancuso, T.F. "Asbestos - An Environmental Health Hazard" Northwest Medicine 66:731-833. J Occ Med 10:33 (1968)

1967 Bryson, George and Bischoff, Fritz "Silicate-Induced Neoplasms" Progress in Experimental Tumor Research 9:77-164

1967 Weiss, Wm. "Cigarette Smoking and Diffuse Pulmonary Fibrosis" Arch. Environ. Health 14:564-568

*1968 Balzer & Cooper, "The Work Environment of Insulating Worker", Amer. Indust. Hygiene Assoc. J., Vol. 29, 222-227

1968 Appearing in "New Yorker", "The Magic Mineral", Oct. 68, 117-165

*1968 Selikoff, Hammond & Churg, "Asbestos Exposure, Smoking, and Neoplasia", JAMA, Vol. 204, 106-110

*1968 Knox, J.F., Holmes S., Doll, R. and Hill, I.D., "Mortality from Lung Cancer and other causes among Workers in an Asbestos Textile Factory, British Journal of Industrial Medicine 25:293-303

1968 Harries, P.G. "Asbestos Hazards in Naval Dockyards" The Annals of Occupational Hygiene 11:135-145

1968 "Hygiene Standards for Chrysotile Asbestos Dust" The Annals of Occupational Hygiene 11:47-69

*1968 Collins, T.F.B. "Pleural Reaction Associated With Asbestos Exposure, The British Journal of Radiology 41:655-661 (Carcinogenesis Abst 7:113 (1969)

*1968 Cralley, Lewis J., Cooper, W. Clark, Lainhart, William S. and Brown, M. "Research of Health Effects of Asbestos" Journal of Occupational Medicine 10:38-41

1968 Godwin, Melvin C. and Jagatic, George "Asbestos and Mesothelioma" JAMA 11:1009

*1968 Balzer, J. LeRoy "Industrial Hygiene for Insulation Workers" Journal of Occupational Medicine 10:25-31

*1968 Brett, G.Z., "Earlier Diagnosis and Survival in Lung Cancer", Brit. Med. J., Vol 4, 260-262

*1968 Meyer, Bechtold & Jensen, "Positive Sputum Cytologic Tests for Five Years Before Specific Detection of Bronchial Carcinoma", J. of Thoracic and Cardiovascular Surgery, Vol. 57, 318-324

© 1979 Andrews Publications, Inc., All Rights Reserved Reproduction in whole or part strictly prohibited.

1969	Kotin - Joint Atomic Energy Commission hearings
*1969	Fullmer & Parrish, "Pulmonary Cytology, A Diagnostic Method for Occult Carcinoma", ACTA Cytologica, Vol. 13, 645-651
1969	Kaufman, Jack and Wright, George W. "The effect of nasal and nasopharyngeal irritation on airway resistance in man" American Review of Respiratory Disease 100:626-630
*1969	Newhouse, M.L. "A study of the mortality of workers in an asbestos factory" British Journal of Industrial Medicine 26:294-301
*1969	Wright, George W. "Asbestos and Health in 1969" American Review of Respiratory Disease 100:467-479
1969	Buell, George C. "Biochemical Parameters in Inhalation Carcinogenesis" AEC Symposium Series 18 pp. 209, 221 and 222
1969	Weiss, William "Cigarette Smoking and Diffuse Pulmonary Fibrosis" American Review of Respiratory Disease 99:67-72
1970	Carnow, Senior, Karsh, Wessler & Avioli, "The Role of Air Pollution in Chronic Obstructive Pulmonary Disease", JAMA, Vol. 214, 11/2/70, 894-899
1970	Selikoff, Hammond & Churg, "Mortality Experiences of Asbestos Insulation Workers", Pneumoconiosis, 180-186
1970	McDonald, A.D., Harper, A., El Attar, O.A. and McDonald, J.C. "Epidemiology of Primary Malignant Mesothelial Tumors in Canada" 26:914-919
1970	Gross, Paul, Tuma, Jiri and DeTreville, Robert T.P. "Fibrous dust particles and ferruginous bodies" Archives of Environmental Health 21:38-46
*1970	Gerber, Michael A. "Asbestosis and Neoplastic Disorders of the Hematopoietic System" American Journal of Clinical Pathology 53:204-208
1970	Mattson, Stig-Borje and Ringquist, Torsten. "Pleural Plaques and Exposure to Asbestos" Scandinavian Journal of Respiratory Diseases. Supp. No. 75:1-41
1970	Davis, John M.G., Gross, Paul, and deTreville, Robert T.P. "'Ferruginous Bodies' in guinea pigs" Archives of Pathology 89:364-373
*1970	McEwen, J., Finlayson, Angela, Mair, A., and Gibson, A.A.M. "Mesothelioma in Scotland" British Medical Journal 4:575-578
1970	Wagner, J.C. "Induction of experimental tumors of the pleura by fibers (asbestos)" Experimental Cancer Therapy 2:446-451
1970	El-Sewefy, A.Z., Awad, S., and Abdel-Salam, M.C. "Chest Symptomatology in an Egyptian Cement-Asbestos Pipe Factory" The Journal of the Egyptian Medical Association 53:84-92
1970	Ashcroft, T. and Heppleston, A.G. "Mesothelioma and Asbestos on Tyneside" Pneumoconiosis - Proceedings of the International Conference Johannesburg 1969
1970	Gross, Paul, deTreville, Robert T.P. and Cralley, Lewis J. "Studies on the Carcinogenic effects of Asbestos Dust" ibid 220-224
1970	Becklake, Margaret R., Fournier-Massey, Gisele G., McDonald, J.C., Siemiatycki, J. and Rossiter, C.E. "Lung function in relation to Radiographic Changes in Quebec Asbestos Workers" ibid 233-236
1970	Kotin, et al (Surgeon General Report)
1970	Fletcher, D.E. and Edge, J.R. "The Early Radiological Changes in Pulmonary and Pleural Asbestosis" Clinical Radiology 21:355-365
1970	Kellermeyer, R.W. and Warren, K.S. "The Role of Chemical Mediators in the Inflammatory Response Induced by Foreign Bodies; Comparison with the Schistosome Egg Granuloma" The Journal of Experimental Medicine 131:21-39
1970	Davis, J.M.G. "The Long Term Fibrogenic Effects of Chrysotile and Crocidolite Asbestos Dust Injected into the Pleural Cavity of Experimental Animals" The British Journal of Experimental Pathology 51:617-627
1970	Heller, Richard M., Janower, Murray L., and Weber, Alfred L. "The Radiological Manifestations of Malignant Pleural Mesothelioma The American Journal of Roentgenology Radium Therapy and Nuclear Medicine 108:53-59
1971	Martini, Melamed & Clifton, "Occult Lung Cancer Diagnosed by Cytology", Memorial Sloan-Kettering Cancer Center Clinical Bulletin, Vol. 1, 107-110
*1971	Langer, Selikoff & Sastre, "Chrysotile Asbestos in the Lungs of Persons in New York City", Archives of Environmental Health, Vol. 22, 348-361
1971	CPR Research "Industrial Safety and Health Report, Nov. 15, 1971, 21 pages.
*1971	Elmes & Simpson, "Insulation Workers in Belfast, 3. Mortality 1940-1966", Brit. J. of Industrial Med., Vol. 28, 226-236
1971	Selikoff, I., Hammond, E.C. and Churg, J. "Mortality experience of asbestos insulation workers, 1943-1971" IVth International Conference on Pneumoconiosis, Bucharest, September 29, 1971
*1971	Harries, P.G. "Asbestos Dust Concentrations in Ship Repairing: A Practical Approach to Improving Asbestos Hygiene in Naval Dock Yards" The Annals of Occupational Medicine 14:241-254
1971	"Asbestos-The need for an feasibility of air pollution controls" National Academy of Sciences
1971	Reitze, William B., Nicholson, William J., Holaday, Duncan A. and Selikoff, Irving J. "Application of Sprayed Inorganic Fiber Containing Asbestos: Occupational Health Hazards" American Industrial Hygiene Association Journal Mar '72, 178-191
1971	McDonald, J. Corbett, McDonald, Alison D., Gibbs, Graham W., Siemiatycki, Jack and Rossiter, Charles E. "Mortality in the Chrysotile Mines and Mills of Quebec" Archives of Environmental Health 22:677-686
1971	Murphy, Raymond L.H. Jr., Ferris, Benjamin G. Jr., Burgess, Wm. A. Worcester, Jane and Gaensler, Edward A. "Effects of Low Concentration of Asbestos" The New England Journal of Medicine 285:1271-8
1971	Jodoin, Gilles, Gibbs, G.W., Macklem, P.T., McDonald, J.C. and Becklake, Margaret R. "Early Effects of Asbestos Exposure on Lung Function" American Review of Respiratory Disease 104:525-535
1971	Regan, Gillian M., Tagg, Beryl, Walford, Joan and Thomson, M.L. "The Relative Importance of Clinical, Radiological and Pulmonary Function Variables in Evaluating Asbestosis and Chronic Obstructive Airway Disease in Asbestos Workers" Clinical Science 41:569-582

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Reproduction in whole or part strictly prohibited

1971 Stumphius, J. "Epidemiology of Mesothelioma on Walcheren Island" British Journal of Industrial Medicine 28:59-66

1971 Langlands, Jean H M, Wallace, William F.M., and Simpson, Marion. "Insulation Workers in Belfast - I. Morbidity in men still at work" British Journal of Industrial Medicine 28:217-225

1971 Whitwell, F. and Rawcliffe, Rachel M. "Diffuse malignant pleural mesothelioma and asbestos exposure" Thorax 26:6-22

1971 Finlayson, Angela, McEwen, J., and Muir A. "Home interviews with relatives of deceased persons: a means of obtaining histories of exposures to a hazardous substance" Scottish Medical Journal 16:509-512

1971 Ferris, Benjamin G. Jr., Ranadive, Manmohan V., Peters, John M., Murphy, Raymond L.H., Burgess, William A., and Pendergrass, Henry P. "Prevalence of Chronic Respiratory Disease: Asbestosis in Ship Repair workers" Archives of Environmental Health 23:220-225

1971 Smith, Beverly A. and Davis, J.M.G. "The Association of Phagocytosed Asbestos Dust with Lysosome Enzymes" The Journal of Pathology 105:153-157

1971 Reeves, Andrew. L., Puro, Henry E., Smith, Ralph G. and Vorwald A. "Experimental Asbestos Carcinogenesis" Environmental Research 4:496-511

1971 Fletcher, D.E. "Asbestos-related Chest disease in Joiners" Proceedings of the Royal Society of Medicine 64:837-838

1971 Browne, R.C. "Health in Power Stations" ibid 1075-1077

1971 McCallum, R.I. "(a) Dusty Work in the 70's" Royal Society of Health Journal 91/5:246-250

*1971 Luxon, Stuart G. "The Use of Dust Respirators Against Asbestos Dust Hazards in the United Kingdom" American Industrial Hygiene Association Journal 32:723-725

*1971 Weiss, William. "Cigarette smoking, Asbestos, and Pulmonary Fibrosis" American Review of Respiratory Disease 104:223-226

1971 Friedrichs, K.H., Hilscher, W. and Sethi, S. "Study of Tissue Reaction and fibre distribution in Abdominal Granulomas and Lymph Nodes of the Rat following Interperitoneal Administration of Various Amphiboles" International Archives of Occupational Health 28:341-354

1971 Um, Chang-Hyun. "Study of the Secular Trend in Asbestos Bodies in Lungs in London 1936-1966" British Medical Journal 2:248-252

*1972 Selikoff, Nicholson, Langer, "Asbestos Air Pollution", Arch. Environ. Health, Vol. 25, July 1972, 1-13

1972 Kannerstein & Churg, "Pathology of Carcinoma of the Lung Associated with Asbestos Exposure", Cancer, Vol. 30, 14-21

*1972 Nicholson, Maggiore & Selikoff, "Asbestos Contamination of Parenteral Drugs", Science, Vol. 177, 171-173

1972 Roberts & Campbell, "Exfoliative Cytology of Diffuse Mesothelioma" J. of Clinical Pathology, Vol. 25, 577-582

*1972 Selikoff, Hammond & Churg, "Carcinogenicity of Amosite Asbestos", Archives of Environmental Health, Vol. 25, 183-186

*1972 Reitze, Nicholson, Holaday & Selikoff, "Application of Sprayed Inorganic Fiber Containing Asbestos: Occupational Health Hazards", Amer. Industrial Hygiene Assoc. J., Vol. 33, 178-191

1972 "Criteria for a recommended standard...Occupational Exposure to Asbestos" Public Health Service

1972 British Thoracic and Tuberculosis Association and the Medical Research Council Pneumoconiosis Unit "A Survey of Pleural Thickening: Its Relation to Asbestos Exposure and Previous Pleural Disease" Environmental Research 5:142-151

1972 Berry G. "Combined Effect of Asbestos Exposure and Smoking on Mortality from Lung Cancer in Factory Workers" Lancet 2:476-479

1972 Rubino, G.F., Scansetti, G., Donna, A., and Palestro, G. "Epidemiology of Pleural Mesothelioma in North-western Italy (Piedmont)" British Journal of Industrial Medicine 29:436-442

1972 Boucot, Katharine R., Weiss, William, Seidman, Herbert, Carnahan, William J. and Cooper, David A. "The Philadelphia Pulmonary Neoplasm Research Project: Basic Risk factors of lung cancer in older men" American Journal of Epidemiology 95:4-16

1972 Suzuki, Yasunosuke, Churg, J., and Ono, Tetsuro. "Phagocytic Activity of the Alveolar Epithelial Cells in Pulmonary Asbestosis" The American Journal of Pathology 69:373-379

1972 Sanders, Charles L. Jr. "Production of abdominal mesotheliomas in Rats with PuO_2 and Chrysotile Asbestos" Health Physics 23:418

*1972 Becklake, Margaret, Fournier-Massey, Gisele, Rossiter, Charles, E. and McDonald, Corbett J. "Lung Function in Chrysotile Asbestos Mine and Mill Workers of Quebec" Archives of Environmental Health 24:401-409

1972 Adelman, Harold, Berkman, Paul and Sachler, Jay P. "Partial Intestinal Obstruction due to Peritoneal Mesothelioma in Chronic Asbestos Exposure" New York State Journal of Medicine 72:2333-2336

*1972 Beck, E.G., Holt, P.F. and Manojlovic, N. "Comparison of effects on macrophage cultures of glass fibre, glass powder and Chrysotile asbestos" British Journal of Industrial Medicine 29:280-286

*1973 Stell, McGill, "Asbestos and Cancer of Head and Neck," Lancet, Vol.1, p. 678

*1973 Borow, Conston, Livornese & Schalet, "Mesothelioma Following Exposure to Asbestos: A Review of 72 Cases", Chest. Vol 64, 641-646

*1973 "Asbestos, Lung Cancer, Mesothelioma", Lancet, Vol. 1, 813-814

*1973 Stell & McGill, "Asbestos and Laryngeal Carcinoma", Lancet Vol. 2, 416-417

1973 Selikoff, Hammond & Seidman, "Cancer Risk of Insulation Workers in the United States", Biological Effects of Asbestos, 209-216

1973 Hammond & Selikoff, "Relation of Cigarette Smoking to Risk of Death of Asbestos-Associated Disease Among Insulation Workers in the United States", Biological Effects of Asbestos, 312-317

1973 Excerpt-New Yorker Magazine-10/29/73

1973 IBID-11/5/73

1973 IBID-11/12/73

1973 IBID-11/19/73

1973 IBID-11/26/73

1973 Bruce Porter-Saturday Review-"An Asbestos Town Struggles with a Killer" 3/17/73 pp 26-31

1973 Stell, P.M. and McGill, T. "Asbestos and Laryngeal Carcinoma" Lancet-August 25, 1973 pp 416-417

*1973 Newhouse, Muriel L. and Berry, G. "Asbestos and Laryngeal Carcinoma Lancet-September 15, 1973 p.615

1973 "British Occupational Hygiene Society Committee on Hygiene Standard Hygiene Standards for Airborne Amosite Asbestos Dust" Annals of Occupational Hygiene 16:1-5

*1973 Chew, P.K., Chia, M., et al "Asbestos Workers in Singapore. A Clinical functional and radiological survey." Archives of Environmental Health 26: 290-293

1973 Cohen, D. "Ferromagnetic contamination in the lungs and other organs of the human body" Science, 180:745-748

*1973 Cralley, L.J. and Lainhart, W.S. "Are trace metals associated with asbestos fibers responsible for the biologic effects attribute to asbestos [illegible] Journal of Occupational Medicine, 15:262-266

1973 Cunningham, H.M., Pontefract, R.D., "Asbestos fibers in beverages, drinking water and tissues: their passage through the intestinal wall and movement through the body" Journal of the Association Offic. Analytic Chemistry, 56:976-[illegible]

*1973 Enterline, Philip, DeCoufle, Pierre and Henderson, Vivian "Respiratory cancer in relation to occupational exposures among retired asbestos workers" British Journal of Industrial Medicine 30:162-166

1973 Editorial - "Asbestos-Lung Cancer-Mesothelioma" Lancet 4/14/73 p. 81-816

1973 Lesobre, R., Hadengue, A. and Legrand, M. "Les manifestations pleurales de l'asbestose" La nouvelle Presse Medicale 14:1491-1494

1973 Taskinen, Eero, Ahlmann, Kai, and Wiikeri, Matti. "A current hypothesis of the lymphatic transport of inspired dust to the parietal pleura" Chest 64:193-196

1973 Wagner, J.C., Berry, G. and Timbrell, V. "Mesotheliomata in rats after inoculation with asbestos and other materials" British Journal of Cancer, 28:173-185

1973 Hunter, B. and Thomson C. "Evaluation of the tumorigenic potential of vermiculite by intrapleural injection in rats" British Medical Journal 30:167-173

1973 Report of the advisory committee on asbestos cancers to the Director of the International Agency for Research on Cancer. British Journal of Industrial Medicine 30:180-186

1973 Viswanathan, P.N., Rahman, Qamar Beg, M.U. and Zaidi, S.H. "Pulmonary Lysosomal Enzymes in Experimental Asbestosis in Guinea Pigs" Environmental Physiology and Biochemistry 3:120-126

1973 McDonald, Alison D, Magner, Desmond and Eyssen, Gail. "Primary Malignant Mesothelial Tumors in Canada, 1960-1968" Cancer 31:869-876

1973 Gross, Paul and Harley, Russell A. "Asbestos induced intrathoracic tissue reactions" Archives of Pathology 96:245-250

1973 "Recommendations for an Asbestos Standard" Journal of Occupational Medicine 15:375-376

*1973 Shin, Moon Lee and Firminger, Harlan I. "Acute and Chronic Effects of Two Types of Asbestos in Rats with a study of the Histopathogenesis and Ultrastructure of the Resulting Mesotheliomas" The American Journal of Pathology 70:291-308

1973 Aponte, Gonzalo E. "Some Current Concepts of the Pneumoconioses" Annals of Clinical and Laboratory Science 3:219-223

1973 "Health criteria and standards for the environment" WHO CHRONICLE 27:108-110

1973 Maroudas, N.G., and O'Neill, C.H. Fibroblast anchorage in carcinogenesis by fibres" Lancet 1:807-809

1973 Viswanathan, P.N., Dogra. R.K.S. Shanker, R. and Zaidi, S. "Pulmonary fibrogenic response of guinea pigs to amosite dust" International Archives of Occupational Health 31:31-39

1973 Morgenroth, K. "Cellular reaction in the Human Lung caused by inhalation of asbestos dust over long periods" Beitrage zur Patholo An International Journal of Pathology 148:199-210

1973 Ashcroft, T. and Heppleston A.G. "The Optical and Electron Microscopic Determination of Pulmonary Asbestos Fibre Concentration and Its Relation to the Human Pathological Reaction" J of Clinical Pathology 26:224-234

1974 Hughes, "Lung Disease related to Exposure to Asbestos", Medicine, Science and the Law", Vol. 14, 147-151

1974 Libshitz, Wershba, Atkinson & Southard, "Asbestosis and Carcinoma of the Larynx, A Possible Association", JAMA, Vol. 228, No. 11, 1371-1372

1974 Martini, Beattie, Cliffton & Melamed, "Radiologically Occult Lung Cancer", The Surgical Clinics of North America, Vol. 54, 811-823

1974 Berry, Skidmore & Timbrell, "The Effects of the Inhalation of Asbestos in Rats", Brit. J. of Cancer, Vol. 29, 252-269

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1974	Greenberg & Davies, "Mesothelioma Register 1967-68", Brit. J. of Industrial Med., Vol. 31, 91-104
1974	Wilson, R., Marcussen, W. and Furst, A. "Intratracheal instillation of asbestos in mice" Proceedings of the Western Pharmacology Society 17:249-250
1974	Davis, J.M.G. "An electron microscope study of the response of mesothelial cells to the intrapleural injection of asbestos dust" British Journal of Experimental Pathology 55:64-70
*1974	Goldfield, Joseph and Brandt, Frederick E. "Dust Control techniques in the Asbestos Industry" American Industrial Hygiene Association Journal 35:799-808
*1974	Flowers, Earl S. "Relationship between exposure to asbestos, collagen formation, ferruginous bodies and carcinoma" American Industrial Hygiene Association Journal 35:724-729
1974	Reeves, Andrew, L., Puro, Henry E., and Smith, Ralph G. "Inhalation Carcinogenesis from Various Forms of Asbestos" Environmental Research 8:178-202
1974	Raybestos-Manhattan Annual Report "Asbestos and Health"
1974	Davies, Philip, Allison, Anthony C., Ackerman, Jill, Butterfield, Ann and Williams, Susan. "Asbestos induces selective release of lysosomal enzymes from mononuclear phagocytes" NATURE 251:423-425
1974	Laurini, R.N. "Diffuse pleural mesothelioma with distant bone metastasis" Acta Pathologica et Microbiologica Scandinavica 82:296-298
1974	Schneiderman, Marvin A. "Digestive System Cancer among Persons subjected to Occupational Inhalation of Asbestos Particles: A Literature Review with Emphasis on Dose Response", Environmental Health Perspectives 9:307-311
1974	Langer, Arthur, M. "Inorganic Particles in Human Tissues and Their Association with Neoplastic Disease" IBID 229-233
1974	Eckardt, Robert E. "Annals of Industry - Noncasualties of the Work Place" Journal of Occupational Medicine 16:472-477
1974	Langer, Arthur A. "The Subject of Continuous Vigilance" Environmental Health Perspectives 9:33-36
1974	Lee, Douglas, H.K. "Biological effects of Ingested Asbestos: Report and Commentary" IBID 113-122
1974	Pordamore A. and Desbordes, J. "Asbestos Bodies and Fibers in Lung Tissues" IBID 147-8
1974	Holt, Paul F. "Small Animals in the Study of Pathological Effects of Asbestos" IBID 205-211
1974	Brown, Arnold. "Lymphohematogenous Spread of Asbestos" IBID 203-204
1974	Webster, I. "The Ingestion of Asbestos Fibers" IBID 199-202
1974	Westlake, G.E. "Asbestos Fibers in the Colonic Wall" IBID 227
1974	Zaidi, S.H. "Ingestion of Asbestos" IBID 239-240
1974	Richart, Robert B. "Technique for the Systematic Examination of Colon-Rectum Specimens" IBID 237
1974	Davis, J.M.G., Bolton, R.E. and Garrett, J. "Penetration of cells by Asbestos Fibers" IBID 255-260
1974	Bruch, J. "Response of Cell Cultures to Asbestos Fibers" IBID 253
1974	Suzuki, Yasunosuke. "Interaction of Asbestos with Alveolar Cells" IBID 241-252
1974	Harington, J.S. "Fibrogenesis" IBID 271-279
1974	Selikoff, Irving J. "Epidemiology of Gastrointestinal Cancer" IBID 299-303
1974	Pooley, Fred. "Locating Fibers in the Bowel Wall" IBID 235
1974	Heppleston, A.G. "Correlation Between the Tissue Response and Asbestos Fiber Content" IBID 293-294
1974	Volkheimer, Gerhard. "Passage of Particles Through the Wall of the Gastrointestinal Tract" IBID 215-223
1974	Pontefract, R.D. "Penetration of Asbestos through the Digestive Wall in Rats" IBID 213-214
1974	Handbook of Hazardous Material p. 17
1974	McDonald, Becklake, Gibbs McDonald and Rossiter "The Health of Chrysotile Asbestos Mine and Mill Workers of Quebec. Arch Envir Health 28:61-68
1974	Rom, William N. and Palmer, Philip E.S. "The Spectrum of Asbestos-Related Diseases" The Western J. of Medicine 121:10-21
1974	Gross et al. "Ingested Mineral Fibers - Do they Penetrate Tissue or Cause Cancer?" Arch. Environmental Health 29:341-347
1975	Rohl, A.N., Langer, A.M., Selikoff, I.J. and Nicholson, W.J. Exposure to Asbestos in the use of Consumer Spackling, Patching and Taping Compounds" Science 189:551-553
1975	Selikoff, Irving J. "Asbestos Disease in the United States 1918-1975" Paper delivered at the Conference on Asbestos Disease, France October 27, 1975 32 pages
1975	Selikoff, Irving J. "Recent Perspectives in Occupational Cancer" AMBIO 4:14-17
1975	WP Magazine 19:37-39 and 68-76
1975	"Recommended Procedures for Sampling and Counting Asbestos Fibers" American Industrial Hygiene Association Journal 36:83-90
*1975	Morgan, A., Evans, J.C., Evans, R.J., Hounam, R.F., Holmes, A. and Doyle, Susan G. "Studies on the Disposition of Inhaled Fibrous Material in the Respiratory Tract of the Rat and its Subsequent Clearance using Radioactive Tracer Techniques" Environmental Research 10:196-207
1975	Scott, J.K. and Hunt, R., "The Diagnosis of Asbestosis" British Journal of Diseases of the Chest 69:31-36

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*1975	Kaw, J.L. and Zaidi, S.H. "In Vitro Studies on the Cytotoxic Action of different Varieties of Asbestos Dust on Macrophages" Acta Pharmacologia et Toxicologica 36:225-235
1975	Dehner, V.A., Beegle, Robert G. and Miller, Walter T. "Asbestos Exposure and Multiple Primary Tumors" American Review of Respiratory Disease 112:181-195
*1975	Assuncao, Jose and Corn, Morton. "The Effects of Milling on Diameters and Lengths of Fibrous Glass and Chrysotile Asbestos Fibers" American Industrial Hygiene Association Journal 36:811-9
*1975	Weill et al "Lung Functions - consequences of Dust Exposures in Asbestos Cement Manufacturing Plants" Archives of Environmental Health 30:88-97
*1975	Scansetti et al "Cement, Asbestos and Cement Asbestos Pneumoconios Archives of Environmental Health 30:317-319
*1975	Shettigara, P.T. and Morgan, Robert W. "Asbestos, Smoking and Laryngeal Carcinoma" Archives of Environmental Health 30:517-519
1975	Desai, R., West, Paul and Richards, Roy. "The Prevention of Asbestos-Induced Hemolysis" Life Sciences 16:1931-1938
1975	Seaman, Wm. B. "The Case of the Dusty Lung" Hospital Practice 10:94-95
1975	Miller et al. "Nonspecific Interstitial Pulmonary Fibrosis" N. Eng. J. of Med. 292:91-93
1976	Editorial "Threat of Asbestos Disease Widens" Medical World News Oct. 18, 1976 pp. 41-48
1976	Selikoff, Irving J. "Asbestos Disease in the United States 1918-1975" Rev. Fr. Mal. Resp. Supp. 4:7-24
1976	Morgan, Robert W. and Shettigara, P.T. "Occupational Asbestos Exposure, Smoking, and Laryngeal Carcinoma" Occupational Carcinogenesis 271:308-310
1976	Nicholson, William J. "Case Study 1: Asbestos-The TLV Approach" Occupational Carcinogenesis 271:152-169
1976	Gillam, J. Dean, Dement, John M., Lemen, Richard D., Wagoner, Joseph K., Archer, Victor E. and Blejer, Hector P. "Mortality Patterns Among Hard Rock Gold Miners Exposed To An Asbest-form Mineral" Occupational Carcinogenesis 271:336-344
1976	Dement, John M., Zumwalde, Ralph D., and Wallingford, Kenneth M. "Discussion Paper: Asbestos Fiber Exposures in a Hard Rock Gold Mine" IBID 345-352
1976	Selikoff, Irving J. "Lung Cancer and Mesothelioma During Prospective Surveillance of 1249 Asbestos Insulation Workers 1963-1974" IBID 448-456
1976	Greenberg, S. Donald, Hurst, George A., Matlage, William T., Miller, John M., Hurst, Irby J. and Mabry, Linda C. "Tyler Asbestos Workers Program" IBID 353-364
1976	Anderson, Henry A., Lilis, Ruth, Daum, Susan M., Fischbein, Alf S and Selikoff, Irving J. "Household-Contact Asbestos Neoplastic Risk" IBID 311-323
*1976	Peers, Thomas R. "Cancer Mortality and Asbestos Products" American Journal of Epidemiology 104:323-326
1976	Reeves, Andrew L. "The Carcinogenic Effect of Inhaled Asbestos Fibers" Annals of Clinical and Laboratory Science 6:459-466
1976	Becklake, Margaret R. "State of the Art-Asbestos-Related Diseases of the Lung and other Organs: Their Epidemiology and Implications for Clinical Practice" American Review of Respiratory Disease 114:187-227
1976	Bjelland, J.C. "Radiology Case No. 12" Arizona Medicine July 1976 373-376
1976	Harington, J.S. "The Biological Effects of Mineral Fibres, Especially Asbestos, as seen from in vitro and in vivo studies" Annales d'Anatomie pathologique 21:155-198
1976	Kreel, Louis "Computer Tomography in the Evaluation of Pulmonary Asbestosis" Acta Radiologica 17:405-412
*1976	Bhagavan, Belur S. and Koss, Leopold G. "Secular Trends in Prevalence and Concentration of Pulmonary Asbestos Bodies-1940 to 1972" Archives of Pathology and Laboratory Medicine 100:539-541
1976	Roberts, G. Hefin "Distant Visceral Metastases inPleural Mesothelioma" British Journal of Diseases of the Chest 70:246-250
*1976	Lumley, K.P.S. "A Proportional Study of Cancer Registrations of Dockyard Workers" British Journal of Industrial Medicine 33:108-11
*1976	Newhouse, Muriel L. and Berry, G. "Predictions of Mortality From Mesothelial Tumors in Asbestos Factory Workers" British Journal of Industrial Medicine. 33:147-151
*1976	Milne, James E. H. "Thirty-two Cases of Mesothelioma in Victoria Australia: A Retrospective Survey Related to Occupational Asbestos Exposure" British Journal of Industrial Medicine 33:115-122
*1976	Yazicioglu, S. "Pleural Calcification Associated with Exposure to Chrysotile Asbestos in Southeast Turkey" Chest 1:43-47
*1976	Zaidi, S.H., Gupta, C.S.D., Rahman, Qamar, Kaw, J.L. and Shanker, Ravi. "Early response of Gastric Mucosa to Ingested Asbestos Dust and the Dissolution of Nickel" Environmental Research 12:139-143
1976	Lemesch, C., Steinitz, Ruth and Wassermann, M. "Epidemiology of Mesothelioma in Israel" IBID 255-261
1976	Rohl, Arthur N., Langer, Arthur M., Wolff, Mary S. and Weisman, Irving. "Asbestos Exposure during Brake Lining Maintenance and Repair" IBID 110-128
76	Sackett, Roger R. "Asbestos Exposure Control at Puget Sound Naval Shipyard" IBID 11:248-260
1976	Harries, P.G. "Experience with Asbestos Disease and its Control in Great Britain's Naval Dockyards" IBID 11:261-267
1976	Welter, Eugene S. "Asbestosis" Journal of Occupational Medicine 18:786

1976	Bellanto, John A. and Casiano, Dominic J. "Asbestosis in West Virginia and Eastern Ohio" The West Virginia Medical Journal 72" 341-344
1976	Suzuki, Y., Churg, Jacob and Kannerstein, Milton. "Ultrastructure of Human Malignant Diffuse Mesothelioma" The American Journal of Pathology 85:241-253
1976	Kovarik, Joseph L. "Primary Pleural Mesothelioma" Cancer 38:1816-25
*1976	Becklake, Margaret L., Fournier-Massey, Gisele and Black, Robert. "Lung Function Profiles in the Chrysotile Asbestos Mines and Mills of Quebec" Chest 69:383
1976	Shearin, J. Connell and Jackson, David. "Malignant Pleural Mesothelioma" The Journal of Thoracic and Cardiovascular Surgery" 71:621-627
*1976	Bolton, R.E. and Davis, J.M.G. "The Short-Term Effects of Chronic Asbestos Ingestion in Rats" 19:121-128
*1977	Hasan, Fayzal, Nash, Gerald and Kazemi, Homayoun. "The Significance of Asbestos Exposure in the Diagnosis of Mesothelioma: A 28 year Experience from a Major Urban Hospital" American Review of Respiratory Diseases 115:761-768
1977	Nash, John T. "Chrysotile Asbestos: Health Effects" Science 197:1232-1234
1977	Maugh, Thomas, H.III "Carcinogens in the Work Place: Where to Start Cleaning Up" Science 197:268-269
1977	Spremulli, E., Wampler, G. Regelson, W. Borochovitz, D. and Handy Y. "Chemotherapy of Malignant Mesothelioma" Cancer 40:2038-2045
1977	Whitwell, F., Scott, Joan and Grimshaw, Myra. "Relationship between occupations and asbestos fiber content of the lungs of patients with pleural mesothelioma, lung cancer and other diseases" Thorax 32:377-386
1977	Legha, S. and Muggia, Franco M. "Pleural Mesothelioma: Clinical Features and Therapeutic Implications" Annals of Internal Medicine 87:613-621
1977	Constantinidis, Kimon "Asbestos Exposure - its Related Disorders" The British Journal of Clinical Practice 31:89-101
1977	Hammond, Cuyler E. "Terminal Optimism" New Times Magazine November 25, 1977 p. [illegible]-63
1977	Kannerstein, Milton; Churg, Jacob; McCaughey, Elliott and Selikoff, Irving J. "Pathogenic Effects of Asbestos" Arch Pathol Lab Med 101:623-628
1977	Freifeld, Stephen "Asbestos Exposure and Laryngeal Carcinoma" JAMA 238(12): 1280
1977	Otto, Von Lieselotte "Zur Wirksamkeit des Betriebsgesundheits-schutzes im Gesundheitsschutz der Frau" Z. Gesamte Hyg. 23(1):23-30
1977	Storeygard, Alan R. and Brown, Arnold L. Jr.: "Penetration of the Small Intestinal Mucosa by Asbestos Fibers" Mayo Clinic Proc. 52:809-812
1977	Rohl, Arthur, Langer, Arthur and Selikoff, Irving "Chrysotile Asbestos: Effects of Human Exposure" SCIENCE 198:282
1978	Federal Register Vol 43 - No. 42 (3-2-78) p. 8563-8565

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Executive Offices

March 28, 1979

Chairman Carl Perkins
B346C Rayburn House Office Bldg
Washington, DC

Dear Chairman Perkins:

I am happy to enclose with this letter two copies of an addendum to the testimony of Dr. James P. Leineweber of Johns-Manville before the House Subcommittee on Elementary, Secondary and Vocational Education on January 8, 1979.

I would greatly appreciate it if you would include this addendum in the official record of these hearings.

Thank you for your cooperation.

Sincerely,

John S. Autry, Vice President
& Director of Public Affairs

JSA:jac

enclosures: addendums
exhibits

Addendum to the Testimony
of
J. P. Leineweber, Ph.D.

House of Representatives
Committee on Education and Labor
Subcommittee on Elementary, Secondary,
and Vocational Education

During my oral testimoney before the House Committee on Labor and Education, I deviated somewhat from the written testimony which had been submitted to the Committee. I felt that this was necessary to clarify certain points which had been made by those who had testified before me. The major points were:

1. Not all asbestos fibers in the environment can be considered to be biologically active.
2. Not every fiber which is inhaled will remain forever entrapped in the lung.
3. Asbestos related diseases have been shown to follow a dose-response.
4. Concentrations of asbestos fiber as found in the general environment and inside public buildings are below those occupational and para-occupational concentrations which elicit a biological response.

I believe that a consideration of these main points, which have been thoroughly documented in the scientific literature, should serve to reduce the understandable inordinate concern which has been expressed by certain individuals with limited information. The following are more detailed explanations of these points including the pertinent references to the articles in the scientific and medical literature.

Not All Fibers Are Biologically Active

A considerable amount of research has been carried out in recognized laboratories on the toxicological properties of asbestos and other fibers. By far the most thorough, and pehaps the most significant, is the work which has been done by Dr. Merle S. Stanton of the National Cancer Institute. He has studied the ability of a variety of fibrous materials to induce cancer in rats in the laboratory. His experimental technique involves implantation in the pleural cavity which is not at all representative of natural inhalation. Because of its artificial nature it can only be used to screen materials for potential biological activity. He has found that all fibers, regardless of their chemical composition, can be biologically active provided they meet two requirements; (a) they are durable in the biological system and (b) they fall within certain critical size limits. These size limitations, as defined by Dr. Stanton's latest work, are defined as fibers less than 1.5 micrometers in diameter and longer than 8-10 micrometers in length as the most biologically active.

For your information, I am enclosing copies of two of Dr. Stanton's publications which describe his work in detail. The first (Exhibit 1) was a paper on asbestos presented at a meeting of the International Agency for Research on Cancer in Lyon, France in October of 1972. The second (Exhibit 2) was published in the March 1977 issue of the Journal of the National Cancer Institute. Although this paper refers strictly to the carcinogenicity of fibrous glass, it is pertinent in that it represents a most recent work refining the influence of fiber dimensions

Several other studies have been published by other researchers which essentially confirm this work. These publications include those by George W. Wright, M.D., consultant; William E. Smith, M.D., Director of the Health Research Institute, Fairleigh-Dickinson University, Madison, New Jersey; and J. C. Wagner, M.D., Pneumoconiosis Unit, Llandough Hospital, Penarth, Wales.

An additional point in this regard is the fact that airborne fibers found in the general environment and in the air in commercial buildings are generally extremely small, i.e. significantly less than 10 micrometers in length. Thus, the vast majority of the small number of fibers which would be inhaled by the occupants of the building containing asbestos spray coatings cannot be considered in the biologically active size range. This is one reason why I have objected strongly to the reporting of fiber concentrations simply in terms of nanograms per cubic meter. This type of reporting tells nothing about the size range of the fibers encountered and, therefore, eliminates a critical piece of information that is necessary to evaluate the risk. Most analysts and biological researchers now agree that it is important to report the size distribution as well as the total mass of fibers.

Not All Fibers Remain Forever in the Lung

Several of the witnesses at the hearings attempted to leave the impression that once an asbestos fiber is inhaled, it remains forever lodged in the lung where it can do its damage. This is patently false. It is true that asbestos fibers are extremely durable and cannot be dissolved by the fluids present in the lung. It is also true, however, that the human lung has the ability to clear itself of foreign material, a fact which is known by everyone, even remotely associated with the biological sciences. Even if a foreign particle should reach the most distant portions of the lung where the muco-ciliary mechanism cannot operate, there is a good probability that it will be ingested by a mobile cell called a macrophage. This cell can carry its burden out to the bronchi where the other clearance mechanisms can operate. Only those who wish to overdramatize environmental exposure to asbestos fiber choose to ignore this very important defense mechanism of the human body. For a very complete discussion of this subject, I call your attention to a book entitled, "Respiratory Defense Mechanisms, Vol. 2" edited by Joseph D. Brian, et al, published by Marcel Dekker, Inc., New York, New York in 1977.

Asbestos Related Diseases Have Been Shown to Demonstrate A Dose Response Relationship

The petition which was filed by the Environmental Defense Fund requesting immediate action from the Environmental Protection Agency includes the following statement, "... once a qualitative presumption of carcinogenicity has been established for a substance, any exposure to that substance can be considered to be attended by risk when considering any given population. No exception to this point has yet been demonstrated...". This statement summarizes succinctly the feelings of those who would eliminate all possible exposure to asbestos fiber regardless of its intensity.

There is ample evidence at the present time to demonstrate that asbestos related diseases do indeed exhibit a well-defined dose response effect. This effect would be manifested in two ways. At lower doses, a smaller group of the exposed population will be affected and the latency period will be longer. The latency period is defined as the time between the onset of exposure and appearance of disease.

In support of this dose response hypothesis, I have attached copies of two papers. The first, which is attached as Exhibit 3, is by J. C. McDonald, et al, who studied a large population of people who have been employed in the Quebec asbestos mining industry. In this study, an attempt was made to quantify the exposure for each of the workers and relate it to the incidence of various diseases. They found that the overall mortality was not significantly different from the general population for those exposed to low dust levels, but was significantly higher (20%) for the group which was exposed to the higher concentrations of asbestos fiber.

The next paper, which is attached as Exhibit 4, is by F. Whitwell, et al, from the Department of Pathology, Broadgreen Hospital, Liverpool, England. In this study, the amount of asbestos fiber found in lung tissue was correlated with the incidence of mesothelioma. There is a clear cut conclusion that (a) there is a definite dose relationship between asbestos exposure and mesothelioma formation, and (b) levels of asbestos exposure that do not contribute to the formation of asbestosis are not implicated in the formation of lung cancer.

The above citations are representative of several which establish beyond a reasonable doubt that all diseases normally associated with excessive asbestos exposure, i.e. asbestosis and mesothelioma, are subject to a dose response relationship. Bronchogenic cancer, which is very intimately associated with cigarette smoking, is also subject to a dose response relationship.

Environmental Concentrations of Asbestos Fiber Are Below Those Which Elicit a Response

In the previous section, evidence was cited to show that asbestos related diseases are subject to a dose response relationship. As the concentration of fiber decreases, the incidence disease will decrease. There has been considerable debate in recent years as to whether or not a level exists below which there will be no incidence of disease. There is an increasing body of evidence that, in a very practical sense, such a level does exist. In the attached paper by Whitwell, et al, (Exhibit 4), it is quite clearly indicated that those persons with low lung burdens of asbestos fiber are not at risk for development of mesothelioma.

At the June 1978 meeting of the New York Academy of Sciences, Dr. Hammond and Dr. Selikoff presented a paper which reviewed the mortality experiences of residents in the neighborhood of an asbestos plant. This paper, which is attached as Exhibit 5, show quite clearly that the people who lived in the immediate vicinity of this plant but were not employed there, were at no greater risk for asbestos related diseases than a similar group who lived several miles from the plant. It is most interesting to note that the first attempts to clean this particular dirty plant were to blow the asbestos dust around the neighborhood with no filtration. Samples taken in the attics of houses in the vicinity of the plant indicate that the dust concentrations must have been relatively high, very likely higher than the concentrations experienced in buildings where asbestos spray coatings are in use.

I feel that it is extremely important that all concerned should be aware of the information that is discussed in the preceeding paragraphs. Unfortunately, all too much of the discussion regarding the situation has ignored the existence of this body of literature. What has been done is to take the information available from high level occupational exposures and from relatively high level para-occupational exposures and extrapolate, in an unwarranted manner, to the conditions which exist in the environmental situation. The only logic for this is the belief that the lay public is incapable of assimilating scientific or technical data. I, however, believe that the opposite is true. If given all of the information in an objective manner, the educated layman is quite capable of assimilating the facts and reaching a logical conclusion. I further believe that if all of us who are concerned with this particular problem could be given the opportunity to discuss all of the ramifications in the proper environment, it would be a simple matter to reach a logical conclusion regarding the facts and also to determine a rational course of action.

2/14/79

Exhibit 1

BIOLOGICAL EFFECTS OF ASBESTOS

LYON, October 2-5, 1972

Paper 43A

Some Aetiologic Considerations of Fiber Carcinogenesis

Mearl F. Stanton

(With the technical assistance of Constance Wrench & Eliza Miller).

43A - 1

SOME AETIOLOGIC CONSIDERATIONS OF FIBER CARCINOGENESIS

by

Mearl F. Stanton
(with the technical assistance of Constance Wrench
and Eliza Miller)

The Laboratory of Pathology, National Cancer Institute,
Bethesda, Maryland, U.S.A.

SUMMARY

Various structural forms of asbestos, fibrous glass, and aluminum oxide have been tested for carcinogenicity on the pleura of rats. Preliminary results indicate that all three materials when composed predominantly of durable fibers between 0.5 and 5 microns in diameter and lengths of less than 80 microns are more carcinogenic than fibers smaller or larger than these dimensions or non-fibrous materials of similar composition. The carcinogenicity of asbestos, glass, and aluminum oxide is primarily related to its structure rather than to physicochemical properties.

The exogenous agents which contribute to the cause of cancer generally fall into 1 of 3 major groups; ionizing radiation, chemicals, and viruses. There is a wealth of speculation as to how the members of these groups act to induce cancer, but the mechanisms of their action remain unknown. Asbestos is of particular interest as a carcinogen because it has attributes of two of these groups. In all its forms, asbestos contains chemicals that are carcinogenic under certain conditions. At first hand, the various metallic ions or the polycyclic hydrocarbons that are either inherent, or acquired through processing would seem the best explanation for asbestos carcinogenicity. On the other hand, asbestos particles that are within the dimensional range of viruses are abundant in all forms and conceivably these submicroscopic particles could act in a fashion similar to viruses, whatever that may be.

However, there is reasonably good evidence that neither of these attributes are related to the carcinogenicity of asbestos. The evidence for this conclusion can be summarized as follows:

1. There is no indication that any of the asbestoses are contaminated sufficiently with known carcinogenic hydrocarbons to account for their carcinogenicity, and rigorous extraction of those hydrocarbons present in asbestos does not affect its carcinogenicity for the pleura of the rat (Wagner, J.C. et al. 1970).
2. Variations in inherent metallic content of various types of asbestos are great, yet these various types of asbestos show only slight differences in carcinogenicity (Harrington, J.S., 1965; Timbrell V., 1970; Wagner J.C. et al. 1970B; Stanton et al., 1972).

3. Finely particulate metallic nickel, stainless steel, or non-crystalline silicon dioxide applied to the pleura of the rat are not sufficiently carcinogenic to account for the carcinogenicity of asbestos through mill contamination (Stanton *et al*. 1972).
4. Reduction of fiber size by partial pulverization of asbestos, a process which increases contamination by metallic particles and increases the number of submicroscopic fibrils in asbestos, reduces its carcinogenicity (Stanton *et al*. 1972).
5. Hand-cobbed crocidolite ore, hand milled without metallic contamination, is equal in carcinogenicity to machine-milled crocidolite (Stanton *et al*.1972).
6. Non-asbestiform fibers such as fibrous glass are increasingly carcinogenic as they approach the size range of milled asbestos fibers (Stanton *et al*.1972).

One therefore must consider that the structural features of asbestos may be the critical factor in its carcinogenicity and it is toward this hypothesis that we have directed our attention. If the structural features of asbestos are important, then it follows that similar fibers, if sufficiently durable, should also induce tumors and on this reasoning we have based a large series of experiments. These experiments are still in progress; only preliminary results of part of them are available at this time. For this reason interpretations are limited.

The interpretations of tumor incidence are reasonably conservative and may need to be revised upwards in the final calculations. The analysis of fiber distribution by size is admittedly crude and subject to considerable error, but again we have tried to be conservative in our interpretation.

Materials and Methods:

Various specimens of crocidolite, chrysotile, fibrous glass, and fibrous aluminum oxide were applied by open thoracctomy to the left pleural surface of 30, 11- to 14- week-old, female Osborne-Mendel rats at a single standard 40 mg dose level by a method previously described (Stanton et al., 1969). The single unique aspect of these experiments is that all test materials were applied to small 45 mg fibrous glass pledgets prior to application. The glass pledgets are composed of large-diametered fibrous glass which when intact has no apparent carcinogenicity in itself. We use it simply as a convenient and accurate means of uniformly applying the test material to a wide surface area of the pleura. The test materials are listed in tables 1-4. The UICC standard reference samples of crocidolite and chrysotile A have been previously described (Timbrell V. 1970). These samples were treated by grinding in a stainless-steel ball mill (Spex model 5000) to produce the three pulverized samples, and the crude fibers were stripped by hand from hand-cobbed ore specimens, with an attempt to retain bundles of fibers as long as feasible without contamination by extraneous mineral. This processing was previously described (Stanton et al.1972). The fibrous glasses were obtained from both the Owens-Corning Fiberglas Corporation, Toledo, Ohio, and the Johns-Manville Research and Engineering Center, Manville, New Jersey.

We are particularly indebted to the latter Institution for the size separation of fibrous glasses, which were carried out through a series of millings and sedimentation of exceptionally fine-diametered glass fibers. All of the glasses were of the usual borosilicate type with mineral oxide contents previously recorded (Stanton et al. 1972). The non-fibrous aluminum oxide and aluminum oxide whiskers were commercial products obtained from the Artech Corporation, Falls Church, Virginia. These are single crystal fibers that are more than 99.5% pure Al_2O_3. The method of counting fibers was previously described (Stanton et al. 1972). Samples of the materials suspended in Formvar were air-dried on glass slides and photographed at 1000 magnifications. From the photographs, 1000 consecutively counted particles were assigned to the 30 ranges of dimension indicated in text-figure 1. Assuming that the particles in a given range were normally distributed around the mean size of that range, the total mass of all particles could be calculated, and the percent of the total mass occupied by particles in a given range or size compartment are the figures tabulated in tables 1-4. In the tables, the first entry of each row and ½ the second entry in each row consists of particles that are non-fibrous. The plus figures below the designated specimen indicate the extent of pleural fibrosis most commonly observed in the rats of each experiment. The rats are being observed for 2 years following application. All dead or sick rats are necropsied and histologic sections taken from the site of treatment and any other abnormal lesion. There is a limit to how precisely one can interpret results in terms of tumor response, because rats die at various times and from various causes during the 2-year period.

Nevertheless, from the present rates of mesothelioma development we can estimate the final incidences of mesotheliomas in broad terms of whether the incidence will be high (i.e., > 50%; table 1), moderate to low (i.e., < 40% but > 5%), or negative(table 4).

Results and Conclusions:

The data are arranged in 4 tables according to our preliminary estimates of mesothelioma incidence. In table 1 are the 5 specimens that have yielded a tumor incidence greater than 50%. These are the UICC standard reference samples of crocidolite and chrysotile A, two samples of very fine fibrous glass with diameters of 3 µ or less, and the aluminum oxide whiskers. All of these samples are composed almost entirely of fibers, and further have in common a predominance of fibers below 5 µ in diameter. The Al_2O_3 fibers are of particular interest because they are totally different from asbestos and glass, both in internal structure and chemical composition, yet their size distribution is remarkably like that of UICC crocidolite. However, one-third of the fibers are slightly longer and thicker than the crocidolite fibers and, since the density of Al_2O_3 is greater than asbestos, approximately one-sixth as many fibrous particles are present. The Al_2O_3 fibers are very durable and do not fragment to submicroscopic fibrils as crocidolite does. Whether this persistence of optically visible Al_2O_3 fibers relates to increased carcinogenicity remains to be seen.

Tables 2 and 3 list the 7 samples of asbestos and glass which fell in the middle ground of carcinogenicity. These materials may prove more carcinogenic than we predict at present, but all show a lesser carcinogenic response than those of table 1. These groups show no single outstanding difference in fiber distribution from those of table 1.

Both extremes in the dimensional ranges of fibers are represented. For example, the two crocidolite samples show similar incidences of mesotheliomas, but one is composed almost entirely of long, large-diametered fiber bundles while the other has less than half as many fibers all of which are short and small in diameter. One explanation for this result is that fragmentation of fibers in vivo may play a role. The distributional array of fibers in the glass specimens would strongly indicate that carcinogenicity is decreased if fibers exceed 2.5 μ in diameter.

Finally, table 4 lists 5 samples including asbestos, glass, and Al_2O_3 which thus far have not yielded mesotheliomas. Except for the whole-fibered commercial glass, which is the type used as a vehicle in all experiments, none of these experiments with non-fibrous materials have progressed sufficiently to assure that no mesotheliomas will occur. However, the expected incidence in the remaining 4 groups is far lower than the materials in tables 2 and 3.

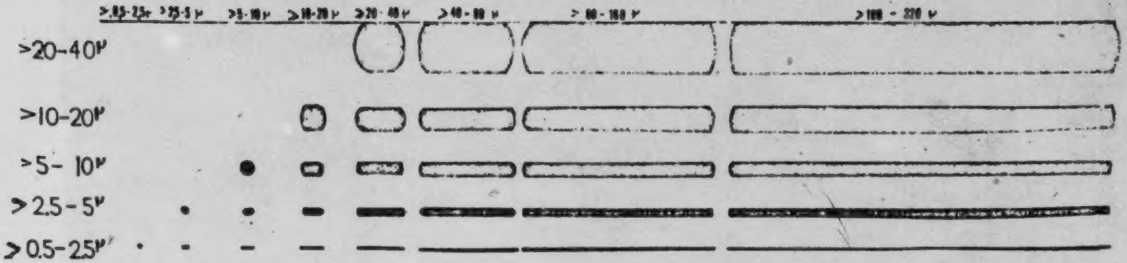
If one analyzes the experiments in terms of individual types of material, some additional points are evident. Comparisons of the 4 samples of crocidolite (sections 1 of tables 1-4) indicated that none of the 3 extremes in fiber distribution yield as high an incidence of mesotheliomas as the more evenly distributed UICC standard reference sample. Either progressive pulverization to non-fibrous form by optical standards or preservation of the test sample in large bundles of fibers clearly reduces carcinogenicity.

In considering the 3 samples of chrysotile (sections 2 of tables 1, 2, and 4), it is again apparent that the presence of particles smaller than 0.5 x 1.5 μ (i.e., the clumps and masses of submicroscopic fibrils represented in the distribution of fully pulverized chrysotile) decreases carcinogenicity and that fibers with diameters of more than 2.5 μ and lengths of more than 80 μ reduce carcinogenicity.

In considering the 8 glass samples (sections 3 and 4 of tables 1-4) conclusions are not as easy. It is apparent that samples composed over 90% by weight of fibers with diameters of 2.5 μ or less are the most carcinogenic and as this diameter is exceeded by more and more fibers carcinogenicity is reduced.8.]Length does not seem critical here since the crude AAA fibrous glass applied virtually intact yielded more mesotheliomas than the same glass reduced to shorter lengths (section 3 of table 1 vs. sections 3 in tables 2 and 3). However, reduced carcinogenicity in the glass samples may have resulted simply from reduction of the fibers to a non-fibrous form or to fused masses of glass of greater than 5 μ in diameter. Final conclusions on this interesting series of sized glass fibers must await more accurate tumor-incidence figures. Nevertheless, it is certain that in the pleura of the rat, fibrous glass of small diameter is a potent carcinogen.

Finally, the contrasting results with the fibrous and non-fibrous forms of Al_2O_3 reemphasize the importance of structure to carcinogenicity. These exceptionally pure, inert fibers composed of materials foreign to asbestos and glass seem to carry the same carcinogenic hazard for the pleura as asbestos and glass.

It would therefore seem that carcinogenicity is in some way related to the presence of a durable particle of fibrous configuration in the dimensional range of optical recognition but presumably very near the limit of this range, and that carcinogenicity of asbestos, glass, or Al_2O_3 has little relation to the chemical composition of these substances or their potential contaminants.


>.05-2.5μ
>2.5-5μ
>5-10μ
>10-20μ
>20-40μ
>40-80μ
>80-160μ
>160-320μ
>20-40μ
>10-20μ
>5- 10μ
>2.5-5μ
>0.5-2.5μ

Text-Figure 1. Graphic illustration of the catagories of size used to classify particles in the test samples. Illustrated particles represent mean dimensions.

TABLE 1
MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE
HIGH INCIDENCE GROUPS (>50% MESOTHELIOMAS)

Length → μ Diameter ↓	>.5 ↓ 2.5	>2.5 ↓ 5	>5 ↓ 10	>10 ↓ 20	>20 ↓ 40	>40 ↓ 80	>80 ↓ 160	>160 ↓ 320
> 20-40								
> 10-20	CROCIDOLITE UICC							
> 5-10	####		1			11	22	
> 2.5-5		1	<1	1	3	3	17	11
> .5-2.5	3	5	7	4	4	2	1	4
> 20-40								
> 10-20	CHRYSOTILE UICC							
> 5-10	####		11					
> 2.5-5		4		4				
> .5-2.5	8	15	14	11	17	7	5	3
> 20-40								
> 10-20	AAA GLASS CRUDE FIBER							
> 5-10	####							
> 2.5-5		1					3	7
> .5-2.5	<1	<1	1	2	2	5	13	65
> 20-40								
> 10-20	AAA GLASS SEPARATED ">10x1μ"							
> 5-10	####							
> 2.5-5		1			3			
> .5-2.5	8	3	6	17	18	10	23	12
> 20-40								
> 10-20	ALUMINUM OXIDE WHISKERS			4	4			
> 5-10	####		3	1	4	8		26
> 2.5-5		1	1	1	5	2	12	6
> .5-2.5	<1	<1	1	2	5	4	4	6

TABLE 2
MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE
MODERATE INCIDENCE GROUPS (40-25% MESOTHELIOMAS)

Length → μ Diameter ↓	>.5 ↓ 2.5	> 2.5 ↓ 5	> 5 ↓ 10	> 10 ↓ 20	>20 ↓ 40	> 40 ↓ 80	> 80 ↓ 160	> 160 ↓ 320
> 20-40	CROCIDOLITE CRUDE FIBER ##							42
> 10-20								22
> 5-10							1	10
> 2.5-5							2	12
> .5-2.5	<1	<1	<1	1	2	2	3	2
> 20-40	CHRYSOTILE LONG FIBER ###							
> 10-20								20
> 5-10								16
> 2.5-5		2					10	12
> .5-2.5	4	2	1	4	2	7	6	14
> 20-40	AAA GLASS SHEARED FIBER ####							
> 10-20				17				
> 5-10			4					
> 2.5-5		4	2	2	11	9	8	
> .5-2.5	7	2	4	9	10	2	1	8
> 20-40	AAA GLASS SEPARATED " >10x3μ" ###							
> 10-20				2	4			
> 5-10			1	1	15	10		
> 2.5-5		3	2	9	22	9	8	10
> .5-2.5	<1	<1	<1	1	2	<1	<1	<1
> 20-40								
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5								

TABLE 3
MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE
LOW INCIDENCE GROUPS (20-5% MESOTHELIOMAS)

Length → µ Diameter ↓	>.5 ↓ 2.5	>2.5 ↓ 5	>5 ↓ 10	>10 ↓ 20	>20 ↓ 40	>40 ↓ 80	>80 ↓ 160	>160 ↓ 320
> 20-40	CROCIDOLITE PARTLY PULVERIZED ///							
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5	54	20	17	9				
> 20-40								
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5								
> 20-40	AAA GLASS PARTLY PULVERIZED ///							
> 10-20								
> 5-10			<1	2		16	32	
> 2.5-5		4	4	2	8	6	4	8
> .5-2.5	1	2	3	2	2	1	1	3
> 20-40	AAA GLASS SEPARATED " <5x1µ" //							
> 10-20								
> 5-10				13				
> 2.5-5		4	10	13				
> .5-2.5	23	11	13	11	2			
> 20-40								
> 10-20								
> 5-10								
> 2.5-5								
> .5-2.5								

TABLE 4
MESOTHELIOMA INCIDENCE IN RELATION TO DISTRIBUTION OF FIBERS BY SIZE
ZERO INCIDENCE GROUPS (NO MESOTHELIOMAS)

Length → µ Diameter ↓	> .5 ↓ 2.5	> 2.5 ↓ 5	> 5 ↓ 10	> 10 ↓ 20	> 20 ↓ 40	> 40 ↓ 80	> 80 ↓ 160	> 160 ↓ 320
CROCIDOLITE FULLY PULVERIZED ↓								
> 20-40								
> 10-20				20				
> 5-10			14					
> 2.5-5		26						
> .5-2.5	40	<1						
CHRYSOTILE FULLY PULVERIZED ↓								
> 20-40					30			
> 10-20				28				
> 5-10			25	5				
> 2.5-5		5	2	<1				
> .5-2.5	3	<1	<1	<1				
COMMERCIAL GLASS WHOLE FIBER ↓								
> 20-40								47
> 10-20								24
> 5-10								21
> 2.5-5						<1	<1	7
> .5-2.5						<1	<1	1
AAA GLASS SEPARATED " <5x3µ" ↓								
> 20-40								
> 10-20					29			
> 5-10			6	2	4			
> 2.5-5		5	9	20	14	2		
> .5-2.5	3	2	3	1	<1			
ALUMINUM OXIDE NON-FIBROUS ↓								
> 20-40					28			
> 10-20				31	19			
> 5-10			10	4				
> 2.5-5		5	1					
> .5-2.5	2	<1						

REFERENCES

1. Harrington, J.S. (1965) Chemical studies of asbestos. Annals of the New York Academy of Science 132, 31-47.
2. Stanton, M.F., Blackwell R. and Miller, E. (1969) Experimental pulmonary carcinogenesis with asbestos. American Industrial Hygiene Association Journal 30, 236 - 244.
3. Stanton, M.F. and Wrench, C. (1972) Mechanisms of mesothelioma induction with asbestos and fibrous glass. Journal of the National Cancer Institute. 48, 797 - 821.
4. Timbrell, V. (1970) Characteristics of the International Union Against Cancer standard reference samples of asbestos. Pneumoconiosis: Proceedings of the International Conference, Johannesburg 1969. Cape Town, Oxford University Press pp. 28-36.
5. Wagner, J.C., Berry, G.and Timbrell, V. (1970A) Mesotheliomas in rats following the intrapleural inoculation of asbestos. Pneumoconiosis: Proceedings of the International Conference, Johannesburg 1969. Cape Town, Oxford University Press pp.216-219
6. Wagner, J.C.(1970B) The pathogenesis of tumors following the intrapleural injection of asbestos and silica. Morphology of Experimental Respiratory Carcinogenesis. AEC Symposium Monograph Series #21, Oak Ridge,Tennessee. Oak Ridge National Laboratories pp. 347-358.

Carcinogenicity of Fibrous Glass: Pleural Response in the Rat in Relation to Fiber Dimension[1]

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ABSTRACT—Seventeen fibrous glasses of diverse type or dimensional distribution induced different incidences of malignant mesenchymal neoplasms when implanted in the pleurae of female Osborne-Mendel rats for periods of more than 1 year. Neoplastic response correlated well with the dimensional distribution of fibers. Fibers less than or equal to 1.5 μ in diameter and greater than 8 μ in length yielded the highest probability of pleural sarcomas, and probability trends suggested that pleural sarcoma incidence increased with increasing lengths of fibers with diameters of less than 1.5 μ. Morphologic observations indicated that fibers less than or equal to 8 μ in length were inactivated by phagocytosis. In fibers greater than 8 μ in length, the correlation of carcinogenicity with increasing length was difficult to explain. Since neoplastic response to a variety of types of durable fibers, particularly asbestos fibers, was similar, our experiments reinforce the idea that the carcinogenicity of fibers depends on dimension and durability rather than physicochemical properties and emphasize that all respirable fibers be viewed with caution.—J Natl Cancer Inst 58: 587–603, 1977.

At the 1970 Symposium on Tissue Response to Asbestos held in Cardiff, Wales, we reported that exceptionally fine fibrous glass applied to the pleura of the rat induced sarcomas that were identical to the neoplasms induced with asbestos at this site and closely resembled mesotheliomas induced in the pleura of man by asbestos. Ancillary data suggested that the carcinogenicity of both asbestos and glass was related to the dimensional configuration of the fibers rather than to either their physicochemical properties or contaminating oils or metals. Further support for the concept that fiber carcinogenicity depended on durability and fibrous configuration of the proper dimension was attained in two subsequent reports in which the dimensional distribution of fibers of several types of asbestos, glass, and aluminum oxide was correlated with carcinogenicity (*1*, *2*). The present report extends these findings by more precise assessments of both carcinogenicity and the dimensional distribution of fibers in the 17 different types of fibrous glass tested thus far.

MATERIALS AND METHODS

Rats and implantation procedures.—The rats used and the method of exposing the pleura to fibrous glass were essentially those described in (*1*). We have consistently used female, specific-pathogen-free, Osborne-Mendel rats from the outbred, closed colony of the NIH Animal Production Section. As untreated controls, more than 1000 old female Osborne-Mendel rats have been examined during the past 6 years. In our animal housing, the rats generally remained free of chronic pneumonitis, and no tumors were found in the thorax that might be confused with those induced in the pleura. At weaning, the litters were mixed randomly and the rats were housed 5 per large polycarbonate cage. They were fed commercially prepared rodent pellets and water ad libitum and treated between 12 and 20 weeks of age.

As in previous experiments, a substrate pledget of coarse fibrous glass was used as the vehicle for implanting the test fibers. In all experiments, the surface of flat, 45-mg pledgets composed of autoclaved, binder-coated, coarse fibrous glass of the type commonly used as insulation material, was coated with a standard dose of 40 mg test fibers that had been suspended in 1.5 ml of 10% gelatin by gentle continuous agitation. The gelatin-suspended coatings of test fiber were allowed to harden on the pledgets at 4° C, so that the pledgets developed a rubbery consistency. Treatment consisted of a left-sided open thoracotomy under ether anesthesia and the direct placement of the pledget over the visceral pleura. Application in this manner had several advantages: The pledgets could be manipulated easily so that the test fibers on the surface of the pledget could be applied uniformly to a broad surface of the visceral pleura. Additionally, it permitted the application of fibers that could not pass readily through a hypodermic needle, insuring that fibers were included that otherwise would have been fragmented or selectively filtered out by the injection procedures. Further, the coarse fibrous glass pledget acted as a partial barrier between the incision and the test material, thus retarding migration of the test fibers into the incision and surrounding tissues with the subsequent induction of tumors at extraneous sites.

Initially in each experiment, 30 rats were treated. The 1-3% of rats that died postoperatively within 3 weeks were replaced so that each group consisted of 30 long-term survivors. All groups were observed daily; only moribund rats were killed. An effort to insure long-term survival required the surgical removal of all mammary tumors as soon as they became palpable. The survivors were killed during the 25th month after treatment. Periodically during the progress of the experiments, groups of 30 rats were treated as controls with gelatin-saturated pledgets of the coarse fibrous glass vehicle, comparable in weight (85 mg) to the test fibers plus vehicle. The 130 treated control rats from these groups that died during the 24 months following treatment or that were randomly killed the 25th month after treatment comprised experiment #17 on which the calculations of significance are based. Gross necropsy findings were recorded on all rats, and histologic sections were examined after staining with H & E from all im-

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Abbreviation used: H & E = hematoxylin and eosin

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plant sites and all other grossly abnormal tissues. Special histologic stains were done occasionally.

Tested glass fibers.—The 17 tested fibrous glasses are listed in table 1 in order of decreasing carcinogenicity. They are designated by symbols that indicated their source, method of preparation, and relation to each other. The seven samples with a first letter designation "M" were processed by Dr. James Leineweber and the staff of the Johns-Manville Research and Engineering Center. Their methods of preparation, which consisted primarily of fragmentation of aqueous suspensions by blender and subsequent separation by centrifugation and filtration, have been published in (*1*). The M samples represent three starting batches of either flame-attenuated or rotary-processed borosilicate fibrous glass. The mineral content of the batches was similar to that of the fine fibrous glasses published in (*1*). Since milling was not used in sample preparation, the M samples were free of extraneous contamination and differed from each other only in dimension. The two M samples with a second letter designation "O" (used in expts 1 and 9) were from a single starting batch of fibers with nominal diameters below 1 μ. The third letter designation of these two samples indicated the aim of final separation into either long (L) or short (S) fibers. Similarly, the M samples with a second letter designation "6" (used in expts 3, 5, and 16) were from a starting batch of fibers of nominal diameter below 2 μ with the third letter designation indicating that the aim of final separation was to achieve either long (L), short (S), or whole (W) fibers (i.e., nonseparated fibers). Finally, the M samples with second letter designation "8" (used in expts 8 and 15) were from a batch of fibers of nominal diameter below 3 μ and again long (L) and short (S) lengths were the aim in separating the two samples.

The remaining four starting batches of fibrous glass were characterized in (*1*). The six samples with a first letter designation "K" (used in expts 2, 4, 6, 7, 10, and 12) were from a single batch of flame-attenuated borosilicate glass with a nominal diameter range of 0.06 to 3.0 μ and labeled AAA fibrous glass. Samples designated "KW" and "KL" (used in expts 2 and 4, respectively) represent the whole untreated K fibers and a modest attempt to shear these fibers to lengths that remained long but within a range that could be more easily measured. We did the shearing by processing an aqueous suspension of the whole fibers in a conventional Waring blender for three periods of 10 minutes and selecting sedimentation fractions that had predominating fibers greater than 50 μ in length. Samples designated "KCP," "KUP," "K2P," and "KFP" (used in expts 6, 7, 10, and 12) are the same K fibers processed primarily by comminution to short lengths in a Spex ball-mill with a stainless-steel ball and chamber. This treatment contributed significantly to contamination of the fibers by metallic deposition from the chamber. The duration of milling was 30 seconds for experiments 6 and 7, 2 minutes for experiment 10, and 10 minutes for experiment 12. Depending on the duration of milling, the additional content of the following metals was present in the samples by spectrographic analysis: chromium, 0.4–2.3%; copper, 0.001–0.025%; iron, 0.6–9.5%; magnesium, 0.01–0.02%; molybdenum, 0.002–0.015%; and nickel, 0.06–1.2%. In addition, sample KCP differed from the other K samples in that it retained a thin outer binder of heat-cured, urea-formaldehyde resin and small amounts of contaminating urea, mineral oil, and silicone.

Samples with first letter designations "O," "P," and "Y" were from three separate batches of fibrous glass of the type and size range commonly used commercially. These fibers had diameters three to five times greater than the M or K test fibers in the range of 3 and 25 μ—only rare fibers were less than 1 μ. All three samples had long fibers that required shortening for adequate application and measurement. Sample "O2P" (expt 11) was a silica-slag-derived mineral wool commonly used in the past as home insulation. It was composed of brittle, tapered fibers with hooklike attenuations that were highly irritating to the skin. This material contained higher levels of calcium and magnesium oxide than borosilicate glass and additionally was contaminated by metals from a 2-minute period of milling in a stainless-steel Spex mill. Sample "P2P" (expt 13) was a fibrous glass commonly used in filtration processes that contained higher levels of sodium and calcium oxides than conventional borosilicate glasses. It too was reduced to manageable lengths by comminution in the Spex ball-mill for 2 minutes with consequent contamination from this source. Finally, the two samples with the first letter designation "Y" (expts 14 and 17) were from typical, modern, insulation-type fibrous glass that was coated with a phenol-formaldehyde binder. This was the same coarse-diameter fibrous glass that served as the vehicle for implantation of all test samples in this series and in those reported previously. The fibers were twisting strands of exceptionally long length that necessitated approximations in the assessment of this dimension. Sample "YW" (expt 17), whole fibers from the pad employed as the vehicle, was simply increased in amount to equal the weight of the vehicle plus test sample. Sample "Y2P" was the same glass reduced to shorter fibers by comminution in the Spex ball-mill for 2 minutes. Like the other samples with third letter designations of "P," this sample also contained contaminating metal from the mill.

Estimation of particle size distribution.—Aliquots of each of the 17 samples were placed on microscopic slides and on Formvar-coated electron microscopic grids. When appropriate, these aliquots were diluted with distilled water and sonically vibrated to make more uniformly distributed suspensions. The preparations were then air dried. From each slide preparation, a series of microscopic fields thought to best represent the distribution of particles were photographed at final magnifications of ×100 to ×2,000 as appropriate to permit length and diameter measurements of each particle to the nearest 0.50 μ. In most cases, this required a series of step-wise magnifications of the same fields and the development of montages so that extremes in dimension could be adequately assessed. Approximately 1,000 consecutively counted particles within these fields yielded relatively stable ratios between a series of size ranges. At least

1,000 particles were counted in each preparation except for those few with exceptionally long fibers. This tabulation of all particles visible by light microscopy insured a sufficient sample, but it did not adequately take into account particles less than 0.50 μ in diameter. Consequently, the grid suspensions were viewed in an AEI EM6B electron microscope and photographed at final magnifications of ×1,555 to ×19,600, and the diameter and length of each particle in the photographic fields were measured to the nearest 0.01 μ. Again, stepwise increases in magnification and montages were useful in measuring dimensional extremes. From 200 to 1,000 consecutively counted particles were measured; the number depended on the size distribution and the stabilization of ratios among the ranges of size studied. By light microscopic examination of the grids, particles of dimensions previously counted at light magnifications (generally particles with diameters >0.50 μ) could be separated from the submicroscopic particles, and a ratio between the optically visible particles and the submicroscopic particles could be determined. This ratio was used to calculate the number and dimensional distribution of submicroscopic particles presumed to be present in the fields of the 1,000 particles visible by light microscopy that had been counted previously. The dimensions of the total number of particles counted by light microscopy and those of the estimated total submicroscopic particles present in the same fields as those counted by light microscopy were then entered into an IBM 360-370 system computer, and the following calculations were made for each sample.

Assuming the particles were cylindrical, we calculated the volume of each counted particle and converted this value to weight by multiplying by the density of glass. The weights of all counted particles were then summed to yield an estimate of the fraction of the standard 40-mg dose counted. From this estimate, either the number of particles of a given size in the standard 40-mg dose or the percent by weight occupied by particles of a given size could be calculated. The counted particles were then grouped into 34 dimensional ranges that seemed the most likely categories to show differences in response. These arbitrary ranges permitted simple illustrations of fiber distribution both by percent of the dose by weight that was occupied by each range or the number of particles per μg in each range (text-figs. 1, 2). Since it was probable that the count of numbers of particles was no more accurate than one order of magnitude, they were tabulated as the common log with the characteristic of the log representing the probable limit of accuracy.

RESULTS

Table 1 summarizes the results in terms of survival and tumor incidence. Whether or not pleural sarcomas developed, mortality was high especially during the second year after treatment. A scattering of tumors in other sites accounted for some deaths, but these neoplasms were not unusual in untreated controls and no significant trend in incidence could be related to treatment. In all groups, deaths from other than tumors resulted primarily from pneumonia, particularly when inflammation spread to the untreated right lung, since treatment partly compromised the total pulmonary reserve. For these reasons, the best estimate of neoplastic response depended on time of survival as well as the number of tumors.

Table 1 tabulates the time of death and whether or not a pleural sarcoma was present at death for each rat in the 17 experiments. From data similarly tabulated on a weekly basis, a standard actuarial life table method was used to estimate the overall probability of developing pleural sarcomas in each experiment (*4*, *5*). This computation, included in table 1, is derived in the following manner. Let n_x be the number of rats alive at the beginning of week x, and d_x be the number of rats dying of tumor in week x. Then the estimated probability that a rat which survives to the beginning of week x does not die with tumor in week x is

$$P_x = 1 - d_x/n_x.$$

The estimated probability that a rat dies with tumor by the end of week x is

$$q_x = 1 - P_1 \cdot P_2 \cdots P_x.$$

The method adjusts for rats that died early in the experiment without pleural sarcoma, which otherwise would cause the observed proportion of tumors to be less than the tumor probability, had all rats survived until they developed pleural sarcoma or the experiment was terminated. Since both treated control rats and the rats in the experimental groups were subjected to the same implantation procedure, the risk of dying from causes other than tumor was comparable for all groups. Therefore, the assumption underlying actuarial analyses appeared to be satisfied.

The estimated probabilities of pleural sarcoma in the 17 experiments ranged from 85.3% to zero. However, the results suggested division of the experiments into only three response groups excluding the treated controls (footnotes *c*, *d*, and *e* in table 1). The high-risk group consisted of experiments 1–5 from samples composed of either intact fibers or a fraction of the longest fibers from the glass samples with the finest diameters. The intermediate-risk group consisted of experiments 6, 7, and 8. Two of these three experiments were with fine fibers that had been reduced in length by milling, and the third consisted of the long-fibered fraction of large diameter (~2 μ). The eight experiments in the low-risk group (expts 9 through 16) were, for the most part, experiments with either large-diameter fibers or very short fibers.

In testing the combined experiments in each of the three groups for significant differences by the methods of Cox (6) and Mantel (7), we found that, in terms of tumor probability within groups, none of the individual experiments were significantly different from any other. However, the low-risk group was significantly different from the intermediate-risk group ($P<0.01$), which in turn was significantly different from the high-risk group ($P<0.0001$). The differences between the treated controls (expt 17) and the intermediate-risk and

TABLE 1.—*Seventeen experiments with different types of fibrous glass ranked by probability of pleural sarcoma development*[a]

Sample designation	MOL	KL	M6L	KW	MSW	KCP	KUP	M8L	MOS	K2P	O2P	KFP	P2P	Y2P	M8S	MSS	YW
Experiment No. and rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	High-risk group[c]					Intermediate-risk group[d]			Low-risk group[e]								
Probability of pleural sarcoma ±SE[b]	85.3 ±13.2	73.9 ±8.5	71.2 ±9.1	69.3 ±9.6	64.4 ±17.7	21.5 ±8.7	19.4 ±10.3	14.3 ±9.4	8.3 ±5.8	8.1 ±5.5	6.7 ±5.4	5.9 ±5.7	5.7 ±5.5	5.5 ±5.9	4.5 ±4.4	0	0
Wk after treatment	Number dying in stated period after treatment[f]																
6-52	0/13	0/1	0/1	0/5	0/8	0/2	0/4	0/2	0/3	0/2	0/5	0/3	0/5	0/8	0/1	0/2	0/13
53-56	0/1		1/0	1/1	0/1		0/2	0/1	0/1	0/1	0/1						0/3
57-60	2/0				0/3		0/2	0/1					0/3	0/2			0/17
61-64	1/0	1/0					0/1		0/1		0/5			0/1			0/13
65-68		0/1	1/0									0/2			0/1	0/1	0/6
69-72	1/0							0/1							0/1		0/4
73-76							1/0	0/3			0/2	0/1				0/2	0/3
77-80	1/0	1/0		1/0	1/2			0/3	0/1							0/1	0/3
81-84	1/5	1/0	1/0		1/0							0/4			0/1	0/1	0/1
85-88					1/1	1/1	0/2		1/0			0/1	0/1				0/2
89-92		0/1	1/1	1/0	1/1	1/0	0/1	0/2	1/1	1/0				1/0	0/3	0/1	0/4
93-96		2/0	2/3	0/1	1/2	1/0	0/2	1/4		0/2	0/1	0/2	0/1	0/1	0/1	0/3	0/13
97-100	0/1	3/0	2/0	2/0	1/2	0/4			0/1		0/1	0/2	1/1		1/0	0/4	0/9
101-104	3/1	11/7	10/7	11/7	1/3	2/18	2/13	1/12	0/20	1/23	1/14	1/17	0/16	0/19	0/21	0/15	0/41
Σ53-104	9/8	20/9	18/11	16/5	7/15	5/23	3/23	2/28	2/25	2/26	1/34	1/26	1/24	1/23	1/28	0/28	0/119

[a] All expts employed 30 long-term surviving rats except #17 (control, $n = 130$). Standard doses of 40 mg test fibers used in all expts.

[b] Estimated actuarial probability of pleural sarcoma calculated on weekly death rate of rats surviving the first 52 wk after treatment.

[c] High-risk group. Probability of pleural sarcoma significantly higher than intermediate-risk group. Differences between expts within the group not significant.

[d] Intermediate-risk group. Probability of pleural sarcoma significantly higher than treated controls and low-risk group. Differences between expts within the group not significant.

[e] Low-risk group. Probability of pleural sarcoma significantly higher than untreated controls. Data insufficient to distinguish differences from treated controls. Differences between expts within the group not significant.

[f] Number with pleural sarcoma/No. without pleural sarcoma.

high-risk groups were both significant ($P<0.01$ and $P<0.0001$, respectively). However, the low-risk group was not significantly different from the treated controls at the 5% level ($P=0.1$) because the 130 treated controls were insufficient in number to exclude the possibility that single tumors might be the result of either the coarse glass fibers of the vehicle or simple nonspecific injury to the pleura. Subsequent to the completion of this study, three additional groups of treated controls were studied. Three pleural sarcomas were observed in a total of 150 rats from these groups. Thus, although the 1 or 2 neoplasms in the low-risk experiments were significantly different from untreated controls (*see* first paragraph in "Materials and Methods"), the specificity of low-level response seemed doubtful although it may have been the result of the large fibers of the vehicle.

The relationship of the high-, intermediate-, and low-response groups to particular types of fibers suggested, as in previous experiments (*1*, *2*), that tumor response was related to fiber dimension. A good indication of this relationship could be gained if one simply compared the high-, intermediate-, and low-risk probability groups as illustrated in figures 1-17. Ranked in order of tumor probability, the figures indicated that fineness of diameter and increasing length seemed related to carcinogenicity. To test this hypothesis, estimates of the distribution of particles by size were made in each experiment (as described in "Materials and Methods"), and these data were correlated with response. Text-figures 1 and 2 represent a series of dimensional grids, one grid for each experiment, with the fibers grouped into 54 categories of size and tabulated either as percentage of sample weight (text-fig. 1) or by the common logarithm of the number of particles per μg (text-fig. 2). The grid pattern was arranged so that, as one moved from lower left to upper right, the categories increased in diameter and length. Categories on the extreme left were essentially nonfibrous particles, and particles of the upper left categories frequently represented aggregates of submicroscopic particles and fibers. Categories on the right side of the grid were open-ended to accommodate the usual long fibers in many of the samples. In the submicroscopic ranges, fibers greater than 8 μ in length were often difficult to trace for their entire length and were included in the open-end categories. With ideal samples, particles in each sample should have been confined to a narrow range of adjacent categories. Obviously, this was not the case with most of the 17 samples, but the size distribution was sufficiently narrow in some samples to permit tentative conclusions. Comparison of the experiments at the two extremes of tumor probability (expt 1 vs. expts 16 and 17) indicated three patterns of nearly mutually exclusive fiber distribution. The high-risk experiment (expt 1) had a fiber distribution concentrated in the lower right categories of the grid, whereas the negative experiments (expts 16 and

MOL-#1 85.3%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					
>2.5-4.0					
>1.5-2.5					
>.50-1.5		<1	<1	10	64
>.25-.50		<1		14	
>.10-.25		<1	<1	7	
>.05-.10			<1	3	
.01-.05			<1	1	

KL-#2 73.9%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					5
>2.5-4.0			<1	2	2
>1.5-2.5		<1	1	3	38
>.50-1.5		1	<1	19	28
>.25-.50	<1	<1		<1	
>.10-.25	<1	<1	<1	<1	
>.05-.10	<1	<1	<1	<1	
.01-.05	<1	<1	<1	<1	

MGL-#3 71.2%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					
>2.5-4.0				2	3
>1.5-2.5			<1	15	13
>.50-1.5	1	1	1	32	32
>.25-.50	<1	1	1	1	
>.10-.25	<1	<1	<1	<1	
>.05-.10	<1	<1	<1	<1	
.01-.05	·	<1	<1	<1	

KW-#4 69.3%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				1	10
>4.0-8.0				1	13
>2.5-4.0				<1	11
>1.5-2.5		<1	1	1	30
>.50-1.5	<1	<1	1	1	30
>.25-.50	<1	<1	<1	<1	
>.10-.25			<1	<1	
>.05-.10			<1	<1	
.01-.05				<1	

M6W-#5 64.4%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0				2	<1
>2.5-4.0		<1	<1	4	8
>1.5-2.5		<1	1	10	11
>.50-1.5	<1	1	2	27	30
>.25-.50	<1	<1	<1	2	
>.10-.25	<1	<1	<1	1	
>.05-.10	<1	<1	<1	<1	
.01-.05	<1	<1	<1	<1	

KCP-#6 21.5%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				11	
>4.0-8.0			3	18	43
>2.5-4.0		<1	2	2	
>1.5-2.5		<1	1	5	1
>.50-1.5	<1	3	2	3	4
>.25-.50	<1	<1	<1	<1	
>.10-.25	<1	1	<1	<1	
>.05-.10	<1	<1			
.01-.05		<1	<1		

KUP-#7 19.4%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0			<1	18	26
>2.5-4.0		1	4	11	3
>1.5-2.5		2	3	6	
>.50-1.5	<1	6	6	7	5
>.25-.50	<1	<1	<1	<1	
>.10-.25	<1	<1	<1	<1	
>.05-.10	<1	<1	<1	<1	
.01-.05		<1		<1	

M8L-#8 14.3%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					1
>2.5-4.0			<1	4	41
>1.5-2.5		<1	<1	2	31
>.50-1.5		1	<1	1	15
>.25-.50		<1	<1	<1	
>.10-.25				<1	
>.05-.10				<1	
.01-.05					

MOS-#9 8.3%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0			11	45	
>2.5-4.0		6	12	2	
>1.5-2.5		9	1	<1	
>.50-1.5	2	5	1	1	
>.25-.50	1	1	1	1	
>.10-.25	<1	<1			
>.05-.10	1	<1			
.01-.05	<1	<1			

K2P-#10 8.1%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					
>2.5-4.0		5	14	8	
>1.5-2.5		18	17	5	
>.50-1.5	3	23	6	1	
>.25-.50	<1	<1	<1		
>.10-.25	<1				
>.05-.10	<1	<1			
.01-.05					

O2P-#11 6.7%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				38	19
>4.0-8.0			9	18	<1
>2.5-4.0		1	4	5	2
>1.5-2.5		1	1	2	<1
>.50-1.5	<1	<1	<1	<1	<1
>.25-.50	<1	<1	<1		
>.10-.25	<1	<1			
>.05-.10	<1				
.01-.05					

KFP-#12 5.9%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				49	
>4.0-8.0			18	10	
>2.5-4.0		6	8	1	
>1.5-2.5		5	1		
>.50-1.5	<1	2	1	1	
>.25-.50	1	1			
>.10-.25	1				
>.05-.10	1				
.01-.05					

P2P-#13 5.7%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				49	
>4.0-8.0			4	29	10
>2.5-4.0		2	2	2	
>1.5-2.5		1	<1	<1	
>.50-1.5	<1	<1	<1	<1	
>.25-.50	<1				
>.10-.25	<1	<1			
>.05-.10	<1	<1			
.01-.05					

Y2P-#14 5.5%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				56	
>4.0-8.0			<1	30	4
>2.5-4.0		1	2	5	
>1.5-2.5		1	<1	1	
>.50-1.5	<1	<1	<1	<1	
>.25-.50					
>.10-.25	<1	<1		<1	
>.05-.10					
.01-.05					

M8S-#15 4.5%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					13
>2.5-4.0		1	7	23	
>1.5-2.5		4	14	23	
>.50-1.5	1	6	6	3	
>.25-.50	1	1			
>.10-.25	1				
>.05-.10	1	1	1		
.01-.05					

M6S-#16 0%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0					
>4.0-8.0					
>2.5-4.0					
>1.5-2.5		1		6	
>.50-1.5	5	34	26	18	
>.25-.50	2	4	1	1	
>.10-.25	1	1	<1		
>.05-.10	<1	1			
.01-.05	<1				

YW-#17 0%

Diameter μ	.01-1	1-4	4-8	8-64	64
>8.0				<1	83
>4.0-8.0				1	14
>2.5-4.0				<1	3
>1.5-2.5				<1	<1
>.50-1.5				1	<1
>.25-.50					
>.10-.25					
>.05-.10					
.01-.05					

Length μ

TEXT-FIGURE 1.—Fiber distribution into 34 dimensional categories by percent of test sample weight for each of the 17 expts ranked by probability of pleural sarcoma

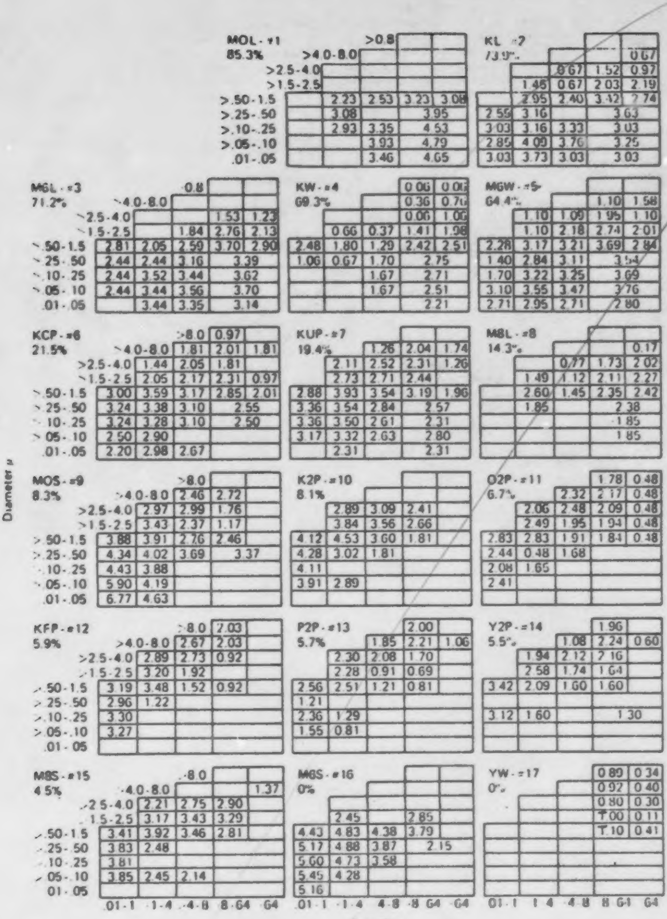


FIGURE 2.—Fiber distribution into 54 dimensional categories by common log of the number of particles per μg in each size category for each of the 17 expts ranked by probability of pleural sarcoma.

17) had fiber concentrations in either the upper right or lower left categories of the grid. These three experiments suggested that fibers in the submicroscopic range (i.e., diameters, ≤0.5 μ) and most likely those of greatest length in this range were the most carcinogenic. This impression was further augmented by the predominance of fibers with diameters of less than or equal to 0.25 μ and lengths of greater than 8 μ in the remaining four high-risk experiments. Furthermore, in the low-risk experiments (expts 9 through 16), the most consistent deficiencies in fiber distribution were in these same extremes of fineness and length. Two of the three experiments in the intermediate group (expts 6 and 8) also seemed to support the carcinogenicity of submicroscopic long fibers by yielding levels of this type of fiber that fell between those of the high-risk and low-risk groups. The failure of experiment # 7 to yield a higher probability of pleural sarcomas was the unexplained exception. Furthermore, the problem of a low, but potentially significant, risk of pleural sarcomas could not be limited to long fibers in the submicroscopic range, since these categories of fibers could not be detected in most of the experiments in the low-risk group.

Statistical regression techniques afforded a second more refined method of analysis. The logit transformation (5) was applied to the estimated tumor probabilities (P) according to the following formula:

$$\text{logit} = \log\left(\frac{P}{1-P}\right)$$

to relate the logits to the particle size distribution, weighted linear regression methods were used. These methods find the linear function of the form

$$\text{logit} = a + B_1x_1 + \cdots B_kx_k,$$

which best fits the data, where the x_i, $i=1, \cdots, k$, quantify certain features of the particle size distributions (e.g., common logarithm of the number of particles per μg or percent total weight in various size categories). The weights used in this analysis were the estimated standard errors of the tumor probability estimates, which were obtained from the life table analysis (table 1).

As previously noted, inspection of the data readily suggested that a concentration of particles in the relatively thin (diameter, ≤0.25 μ) and long (length, >8 μ) dimensional categories was associated with higher probabilities of tumor. However, it was possible that there were other not easily observable relationships between tumor probability and the particle size distributions. This possibility was explored by the regression techniques described, using as explanatory variables either logarithms of numbers of particles or percent weight, in a variety of dimensional categories. No significant relationship between distributional factors and tumor probability was found, other than the evident positive correlation between "long and thin" particle concentration and tumor probability. A summary of correlation coefficients is given in table 2.

With the use of logarithms of numbers of fibers, two nonoverlapping size categories, used individually, were found to provide good fits to the data. The first of these included fibers with diameters less than or equal to 0.25 μ and lengths greater than 8 μ. The estimated regression equation was

$$\log\left(\frac{P}{1-P}\right) = -3.06 + 0.991x,$$

with a correlation coefficient of 0.93, which reflects a highly significant relationship. The other category comprised fibers with diameters between 0.25 and 1.5 μ and lengths greater than 64 μ. The estimated regression equation was

$$\log\left(\frac{P}{1-P}\right) = -3.14 + 1.340x,$$

with a correlation coefficient of 0.92, again reflecting a highly significant relationship. The graphs of these equations, together with the data points for each experiment, are given in text-figures 3 and 4. Since these two explanatory variables were so highly correlated with the logits of tumor probability, it was apparent that they must themselves be highly correlated, and indeed their correlation was 0.95. The consequence of this high correlation was that it was impossible to conclude, on the basis of these experiments, which group of fibers was the more important one for carcinogenesis.

Similar regression analyses with the use of percent of total weight of particles as explanatory variables led to diameters between 0.25 and 1.5 μ with lengths greater than 64 μ as the dimensional range which best explained tumor probability. The regression equation was

$$\log\left(\frac{P}{1-P}\right) = -2.30 + 0.095x,$$

with a correlation coefficient of 0.88 (*see* table 2, text-fig. 5). For the range with a diameter of less than or equal to 0.25 μ and length of greater than 8 μ, the percent weight gave a relatively poor fit. The regression equation was

$$\log\left(\frac{P}{1-P}\right) = -1.84 + 0.356x,$$

with a correlation coefficient of 0.51 (*see* table 2, text-fig. 6).

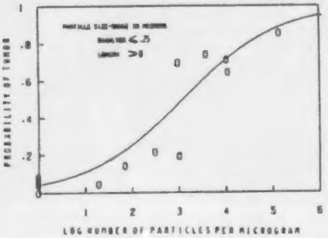
The equations described above could not be interpreted too rigidly because the estimated particle size distributions were subject to considerable sampling error, the range of dimensional variation in the glass types used was in some respects limited, and the particular choices of dimensional range as the explanatory variables were arbitrary and, to some extent, suggested by the data. Nevertheless, taken together, the regression analyses would suggest that glass fibers with diameters less than 1.5 μ and lengths greater than 8 μ were highly carcinogenic in the pleura of the rat and that fibers larger or smaller than these dimensions were less carcinogenic. Thus carcinogenic potential seemed determined by decreasing diameter until at or near the limits of optical visibility, but increasing length became an equally critical factor within this range.

Tissues at the site of implantation in rats dying during

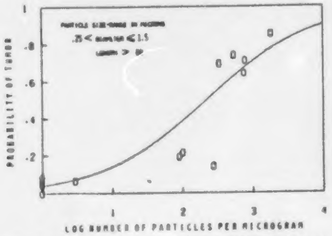
TABLE 3.—*Correlation coefficients of logit of tumor probability with two variables in different dimensional ranges of particle size*

Fiber length, μ	Fiber diameter, μ*			
	>4	>1.5–4	>0.25–1.5	0–0.25
0–8	0.34 −0.29	0.45 −0.33	0.00 −0.41	0.11 −0.26
>8–64	−0.27 −0.40	−0.09 −0.08	0.65 0.63	0.93
>64	−0.10 −0.27	0.63 0.42	0.92 0.88	0.81

* *Upper figure* is correlation coefficient for number of particles/dose; *lower figure* is correlation coefficient for percent by weight of particles/dose.

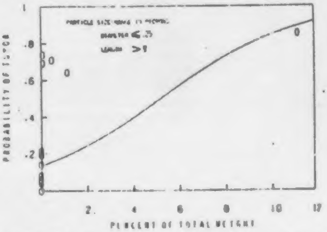


TEXT-FIGURE 3.—Regression curve relating probability of tumor to logarithm of number of particles per μg with a diameter of ≤0.25 μ and a length of >8 μ.

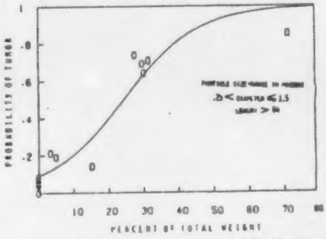


TEXT-FIGURE 4.—Regression curve relating probability of tumor to logarithm of number of particles per μg with 0.25 μ<diameter ≤1.5 μ and a length of >64 μ.

the experiments showed changes that could be assembled into a plausible series of events related to the development of the pleural sarcomas. The basic response to all fibers was typical of that to most foreign bodies, and in particular to the long, coarse fibers employed as vehicle and control. In the acute stage, hyperplasia of the mesothelium and vasodilatation, edema, and polymorphonuclear leukocyte infiltration of the adjacent connective tissue occurred. Tissue necrosis was minimal and the lung was only superficially affected. With all types of fibers, these acute changes at the pleural surface were promptly followed by mobilization and proliferation of vascular granulation tissue from mesenchyme which penetrated the overlying mesothelium and invaded the scaffold of glass fibers. Within the granulation tissue, polymorphonuclear leukocytes were replaced by mononuclear leukocytes, fibroblasts, and especially macrophages. The macrophages either engulfed small particles or adhered closely to large fibers, often fusing to form giant cells that effectively enclosed large fiber segments. For the most part, this process obscured the initially hyperplastic mesothelium, and a thick, uniform coat of vascular granulation tissue infiltrated the glass fibers and covered the affected lung surface. Slowly during the second year, the network of coarse, vehicle glass fibers collapsed and some fragments were carried away by macrophages. But vascular



TEXT-FIGURE 5.—Regression curve relating probability of tumor to percent of total weight of particles with a diameter of ≤0.25 μ and length of >8 μ.



TEXT-FIGURE 6.—Regression curve relating probability of tumor to percent of total weight of particles with 0.25 μ<diameter ≤1.5 μ and a length of >64 μ.

granulation tissue permeated with macrophages, epithelioid cells, and foreign-body giant cells persisted. Notably, the lesions acquired a minimum of collagen. The response to these long, coarse fibers was highly cellular and often showed degrees of disorganization that might be confused with incipient neoplasia. But the lesions never extended beyond the site of fiber deposition nor did they show the anaplastic homogeneity that signals the onset of neoplasia (fig. 18).

Lesions that contained short fibers (expts 9–16), in addition to the long, coarse fibers of the vehicle, were essentially like those just described except that phagocytosis seemed far more successful. Even in the acute stages, an abundance of particle-laden macrophages could be found both at the site and in local lymph nodes. With time, it was apparent that only a small part of the short fibers was transported from the site. Pleural lesions at the end of 2 years had not only the collapsed scaffold of phagocyte-laden, coarse fibers, but also an abundance of short fibers entrapped within phagocytes. Again there was little evidence of collagen deposition even in the midst of abundant particles of both extremes of size.

On the other hand, lesions that predominantly contained fine, long fibers (expts 1–5), in addition to the coarse fibers of the vehicle, followed the pattern of granulation tissue proliferation and phagocytosis as previously described, but phagocytosis seemed inadequate to accommodate the fine, long fibers. In as few as 8 weeks, collagen had begun to accumulate and replace the cellular granulation tissue that invested the fibers. Islands of granulation tissue remained, but for the most part the reactive pleural covering was converted to a patchy, acellular, collagenous matrix which contained abundant, fine, long fibers seemingly free of contact with phagocytes or other inflammatory cells (fig. 19). As in other groups, regional lymph nodes contained phagocytes laden with the smaller fibers, but even though intracellular fibers were abundant, collagen deposition was not apparent in the nodes.

The link between fine, long fibers and collagen deposition was further supported by those experiments that contained small numbers of fine, long fibers among a wide distribution of fiber sizes (expts 6, 7, and 8). In these experiments, the extent of fibrosis was less than in experiments 1–5, but greater than in experiments 9–17. Although only rough comparisons could be made, it was clear that the degree of fibrosis matched the probability of pleural sarcomas. We had no conclusive indication of the exact site of tumor development, but a most likely site seemed to be mesenchyme trapped within the dense collagenous tissue.

During the course of the 17 experiments, 89 pleural sarcomas were observed. The tumors appeared similar in structure to those observed previously in rats with pleural implants of either glass, asbestos, or aluminum oxide fibers (*1*, *2*). The tumors could be divided into those composed almost entirely of elongated spindle cells, those in which the cells assumed bizarre, polymorphic configurations without identifiable characteristics, and those rare neoplasms that assumed an acinar or papillary epithelioid configuration (figs. 20–23). However, all three patterns seemed closely related, since they often merged in a single tumor, and no correlation between experiment and tumor pattern was apparent. The tumors frequently invaded mediastinal organs and occasionally implanted on the opposite pleura, but distant metastases were observed only rarely. One tumor was of particular note in that, although the primary tumor seemed composed entirely of spindle cells, implants of the tumor to the pleura of the opposite lung tended to show a papillary epithelioid differentiation (fig. 23).

DISCUSSION

The results of these experiments raise at least two points that merit discussion, the relationship of fiber dimension to mechanisms of carcinogenesis and the relevance of the findings to human exposure. An early paper (*1*) proposed that fibers at the lower range of optical visibility (i.e., diameters, <1.5 μ) that were exceptionally short (i.e., lengths, <5 μ) might account for the carcinogenicity of several types of glass and asbestos fibers. This hypothesis was not supported by subsequent data (*2*) which, along with those of the present report, indicate that the fine-diameter fibers that are long are carcinogenic and probably become more carcinogenic as their length increases. The negligible carcinogenicity of short fibers is perhaps related to the histologic observation that virtually all coarse- and fine-diameter fibers with lengths of 8 μ or less are efficiently entrapped by phagocytes. Many of the smallest particles are transported to regional lymph nodes, but even those that are not seem completely sequestered within the cytoplasmic limits of macrophages and foreign-body giant cells at the site of implantation. Similar observations have been made with chrysotile fibers in vitro (*8*). If we assume that efficient phagocytosis accounts for the lack of carcinogenicity of fibers less than or equal to 8 μ in length and that levels of tumor response depend on the quantity of fibers not effectively handled by phagocytes, we still must explain why fibers of coarse diameter that are long are less carcinogenic than fibers of fine diameter that are long. Considering that all rats were exposed to equal weights of the various types of fibers, obviously there were far more fine, long fibers than coarse, long fibers per dose. It also holds that fine fibers would have more ends and more surface area as well as a different surface curvature than comparable weights of long, coarse fibers. These differences suggest several hypotheses. It is reasonable that the ends of exceptionally fine fibers could penetrate both cell and nuclear membrane and cause varieties of damage that were not lethal. Nonlethal alteration of the genome is perhaps the simplest and most direct event that could initiate cancer. However, if cellular penetration is responsible for carcinogenesis, then the number of available fine fiber ends should determine the numbers of tumors. Consequently, equal weights of fine fibers of intermediate length should be more carcinogenic than fine fibers of long length. A careful review of the data suggests no evidence of this. Alternately, it has been proposed that the amount of fiber surface area available for cell anchorage might be critical to carcinogenesis (*9*), or that the tightly curved surface of fine fibers might alter anchorage sufficiently to cause cancer. Here again, if carcinogenicity depended simply on the amount of surface area of fine fibers, then equal weights of fine fibers of intermediate length should be equal in carcinogenicity to fine fibers of long length. Although there is some correlation between tumor incidence and the total surface area of fibers greater than 8 μ in length, the data are not sufficient to prove this hypothesis. In fact, a comparison of the intermediate-risk group with the high-risk group suggests that, without apparent difference in total surface area, exceptionally long length enhances carcinogenicity (*see* text-fig. 2, table 2). However, the process of phagocytosis, as it affects all sizes of fibers, needs to be taken into account if one intends to properly assess the number of free ends or the amount of free surface, and this is a problem that does not lend itself well to quantitation. Although present data are inadequate, there may be a direct correlation between tumor probability and the amount of fiber surface free of phagocytic activity. Further, since an apparent correlation exists between the amount of collagen in the lesion and the probability of pleural sarcoma, it is conceivable that collagen acts to block phagocytic activity on fiber surfaces. Collagen deposition alone is unlikely to induce cancer, but fine, long fibers entrapped within collagen and thus freed of phagocytic activity might play a key role.

Collagen deposition relates fiber carcinogenesis to the idea that pulmonary cancer in man is often associated with scarring (*10*) and to experimental carcinogenesis with inert solid sheets (*11, 12*). With solid sheets, carcinogenesis seems to depend on the development of a collagenous envelope at the site which is not unlike the pleural collagen induced by fine, long fibers. With both sheets and fibers, the collagen matrix may be uniquely dense and sufficiently ischemic to force the mutational selection of cells capable of uncontrolled proliferation (*13*). If collagen is a factor, then the question of its character and etiology arises. Our consideration of collagen or cancer mechanism is largely conjecture at the present time, but future experiments with fibers may be an advantage in the study of many questions concerning the general etiology of cancer.

It is of course not necessary to understand the mechanism to appreciate the relevance of these experiments to man. Many of the mesotheliomas of the pleura attributed to asbestos exposure in humans do not differ substantially from the sarcomas of the pleura induced in the rat with implants of the several types of asbestos that we and others have studied (*1, 14–16*). Even though inhaled asbestos reaches the human pleura by a different route than asbestos implanted in the experimental animal, it is unlikely that proximal mechanisms of asbestos carcinogenesis differ in rodents and man. It is our contention that the proximal carcinogenicity of asbestos depends primarily on its exceptionally fine, long dimensions and durability rather than on physicochemical properties (*2*). It follows then that durable fibers of other types should be equally carcinogenic and yield the same types of tumors if they attain the exceptionally fine, long dimensions of asbestos. In the rat, this would seem to be true of the variety of fibers that we have studied thus far, including the glass fibers reported here. To date we have induced significant numbers of pleural sarcomas in rats with fine, durable fibers of the following types: chrysotile, crocidolite, amosite, tremolite, glass, attapulgite, dawsonite, aluminum oxide, silicon carbide, and potassium titanate. Appropriate nonfibrous controls suggest that foreign materials other than long, fine fibers may cause fibrosis, but they do not induce significant incidences of pleural sarcomas. It seems reasonable then to assume that all dusts that contain fine, long, durable fibers, represent a potential hazard to man. Certainly, any measurements of human exposure or consideration of tolerance levels for human exposure should take into account not only the variety of the fiber but also the dimensional character of the fiber.

We have emphasized previously that our experiments explore mechanisms of fiber carcinogenesis at the proximal site of susceptible tissues rather than acting as an estimate of the overall hazard of different fibers to man (*1*). Clearly, fibers must have the opportunity to reach the target tissue to cause cancer. Our experiments are inappropriate for evaluating many aspects of the environmental hazard, since they circumvent those factors that might inhibit or enhance exposure through natural routes. Subtle structural differences in different types of fibers may influence the aerodynamic properties of fibers as well as their penetrability and clearance from the lung. These factors would seem to play an important role in pulmonary exposure to different types of asbestos (*17–19*), and similar factors may well apply to other types of fibers. Although several well-executed inhalation studies with glass particles in animals have indicated no adverse effects (*20–22*), we believe these experiments have not entirely resolved the issue of carcinogenesis by inhalation, since the experiments were in part handicapped by insufficient quantitative measurements of fiber size and dose. Inhalation experiments with glas fibers in narrowly limited dimensional ranges, particularly those ranges found to be the most carcinogenic in the present study, should offer a broad base from which guidelines of safety might be determined.

In the past, it has often seemed that only the painful truth of epidemiologic evidence was sufficient to arouse concern for a potential environmental hazard. It is reassuring then to learn that at present it is unlikely tha anyone has been exposed to quantities of airborne glas fibers of a variety and size comparable to levels of asbestos fibers that are considered to be even minimally hazardous to man (*23–32*). These references also suggest that fibrous glass of the conventional type and dimension has not been a demonstrable cancer hazard to either man or experimental animal, presumably because it exceeds the dimensional range that is carcinogenic. However, unequivocal evidence regarding the response of man to inhaled particles of glass would require th study of far more individuals for much longer times an those exposed to higher levels than those currently reported. Our experiments indicate that the hazard may largely be confined to long fibers of exceptionally fine diameter. Glass fibers of this type have a limited commercial usage and the hazard of exposure seems remote from the more likely exposure to asbestos. Nevertheless, it would seem prudent to regard all respirable fibers with caution. Hopefully, well-designed inhalation experiments will establish safety guidelines, and reasonable monitors and safeguards will make epidemiologic data an impossible achievement.

REFERENCES

(1) Stanton MF, Wrench C: Mechanisms of mesothelioma induction with asbestos and fibrous glass. J Natl Cancer Inst 48:797-821, 1972

(2) Stanton MF: Some etiological considerations of fibre carcinogenesis. *In* Biological Effects of Asbestos (Bogovski P, Timbrell V, Gilson JC, et al, eds). Lyon, France, World Health Organization, International Agency for Research on Cancer, Publication No. 8, 1973, pp 289-294

(3) Spit S, Leineweber J: Personal experiences with making samples of fibres for biological experiments. *In* Fibres for Biological Experiments (Pelnar PV, ed). Montreal, Canada, Institute of Occupational and Environmental Health, 1974, pp 45-50

(4) [illegible] HL, [illegible] JR: Correcting for extraneous death in the evaluation of morbidity or mortality from tumors. Cancer Res 23:15-18, 1963

(5) Armitage P: Statistical Methods in Medical Research. New York, John Wiley & Sons, 1971, pp 376-377, 410-414

(6) Cox D: Regression models and life-tables. J R Stat Soc [B] 34:187-220, 1972

(7) Mantel N: Chi-square tests with one degree of freedom; extensions of the Mantel-Haenszel procedure. J Am Stat Assoc 58:690-700, 1963

(8) Allison AC: Experimental methods—cell and tissue culture: Effects of asbestos particles on macrophages, mesothelial cells and fibroblasts. *In* Biological Effects of Asbestos (Bogovski P, Timbrell V, Gilson JC, et al, eds). Lyon, France, World Health Organization, International Agency for Research on Cancer, Publication No. 8, 1973, pp 89-93

(9) Maroudas NG, O'Neill CH, Stanton MF: Fibroblast anchorage in carcinogenesis by fibres. Lancet 1:807-809, 1973

(10) Raeburn C, Spencer H: Lung scar cancers. Br J Tuberc 51:237-245, 1957

(11) Oppenheimer BS, Oppenheimer ET, Stout AP, et al: The latent period in carcinogenesis by plastics in rats and its relation to the presarcomatous stage. Cancer 11:204-213, 1958

(12) Brand KG, Buoen LC, Johnson KH, et al: Etiological factors, stages, and the role of the foreign body in foreign body tumorigenesis: A review. Cancer Res 35:279-286, 1975

(13) Alexander P, Horning ES: Observations on the Oppenheimer method of inducing tumours by subcutaneous implantation of plastic films. *In* Carcinogenesis: Mechanisms of Action (Wolstenholme G, O'Connor M, eds). Boston, Little Brown & Co., 1959, pp 12-25

(14) Wagner JC: The pathogenesis of tumors following the intrapleural injection of asbestos and silica. *In* Morphology of Experimental Respiratory Carcinogenesis (Nettesheim P, Hanna MG, Deatherage JW, eds). Oak Ridge National Laboratory, Oak Ridge, Tennessee, Atomic Energy Commission Symposium Series No. 21, 1970, pp 347-358

(15) Magner D, McDonald AD: Malignant mesothelial tumors. Histologic type and asbestos exposure. N Engl J Med 287:570-571, 1972

(16) Churg J, Rosen SH, Moolten S: Histological characteristics of mesothelioma associated with asbestos. Ann NY Acad Sci 132:614-622, 1965

(17) Timbrell V, Griffiths DM, Pooley FD: Possible biological importance of fibre diameters of South African amphiboles. Nature 232:55-56, 1971

(18) Timbrell V: Physical factors as etiological mechanisms. *In* Biological Effects of Asbestos (Bogovski P, Timbrell V, Gilson JC, et al, eds). Lyon, France, World Health Organization, International Agency for Research on Cancer, Publication No. 8, 1973, pp 295-303

(19) Gilson JC: Asbestos cancer: Past and future hazards. Proc R Soc Med 66:395-403, 1973

(20) Schepers G: Pulmonary histologic reactions to inhaled fiberglass-plastic dust. Am J Pathol 35:1169-1187, 1959

(21) Gross P: The effects of fibrous glass dust on the lungs of animals. *In* Symposium on Occupational Exposure to Fibrous Glass, vol 2. Rockville, Maryland, National Institute for Occupational Safety and Health, 1974, pp 31-38

(22) Kuschner M: The effects of intratracheal instillation of glass fibers of varying size in guinea pigs. *In* Symposium on Occupational Exposure to Fibrous Glass, vol 2. Rockville, Maryland, National Institute for Occupational Safety and Health, 1974, pp 20-31, quoted by Gross P: The biological categorization of inhaled fiberglass dust. Arch Environ Health 31:101-107, 1975

(23) National Emission Standards for Hazardous Air Pollutants. Federal Register 40(199):48292-48311, 1975

(24) Enterline PE, DeCoufle P, Henderson V: Respiratory cancer in relation to occupational exposures among retired asbestos workers. Br J Ind Med 30:162-166, 1973

(25) British Occupational Hygiene Society Committee on Hygiene Standards: Hygiene standards for airborne amosite asbestos dust. Ann Occup Hyg 16:1-5, 1973

(26) Bjure J, Söderholm B, Widimsky J: Cardiopulmonary function studies in workers dealing with asbestos and glasswool. Thorax 19:22-29, 1964

(27) Newhouse ML: Asbestos in the work place and the community. Ann Occup Hyg 16:97-107, 1973

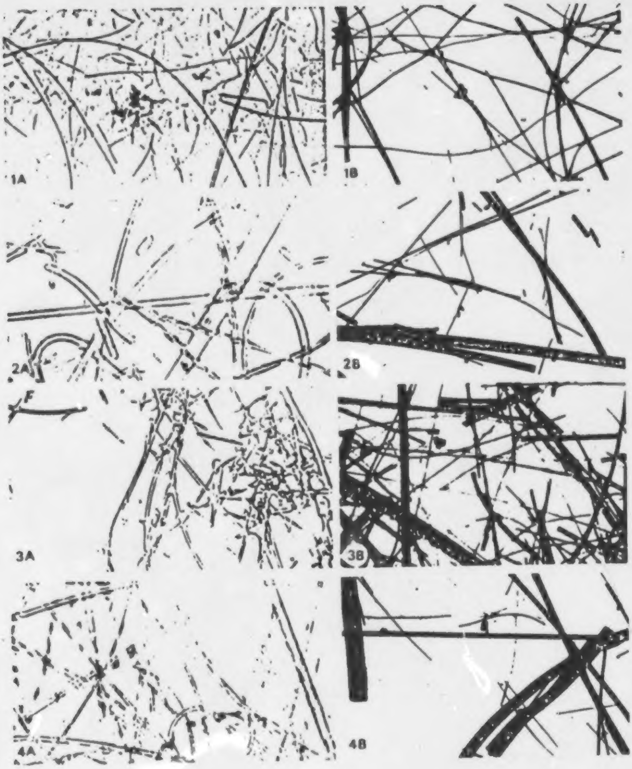
(28) Hill JW, Whitehead WS, Cameron JD, et al: Glass fibres: Absence of pulmonary hazard in production workers. Br J Ind Med 30:174-179, 1973

(29) Enterline P, Henderson V: The health of retired fibrous glass workers. Arch Environ Health 30:113-116, 1975

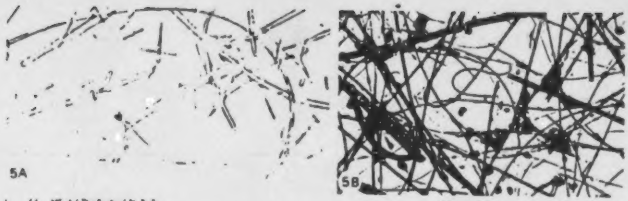
(30) Corn M, Sansone E: Determination of total suspended particulate matter and airborne fiber concentrations at three fibrous glass manufacturing facilities. Environ Res 8:37-52, 1974

(31) Gross P, Tuma J, de Treville R: Lungs of workers exposed to fiberglass. Arch Environ Health 23:67-76, 1971

(32) Schulte P, ed: Occupational exposure to fibrous glass. *In* Proceedings of a Symposium of the National Institute for Occupational Safety and Health. DHEW Publication No. (NIOSH 76-151). Washington, D.C., U.S. Govt Print Off, 1976



FIGURES 1-17.—Silhouettes of samples of the 17 types of glass fibers used. Figures are numbered to correspond to the experiment number and rank for probability of inducing pleural sarcoma. Figures A are all at × 750; figures B are all at × 3,200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6A
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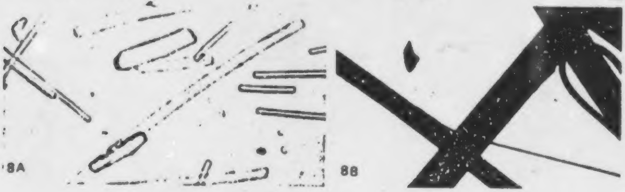
7B


8A
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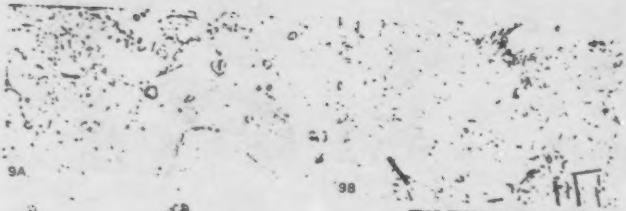
9A
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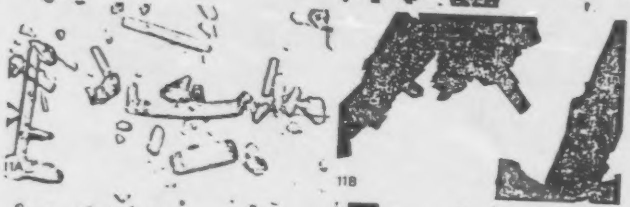
10A
10B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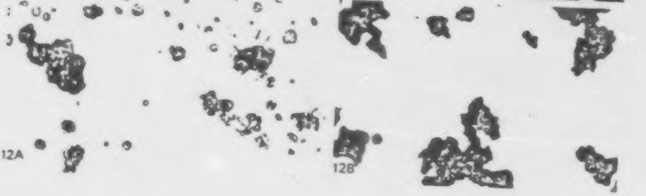
12A
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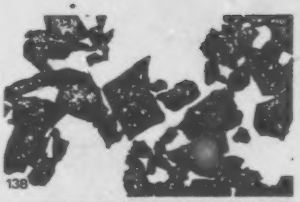
13A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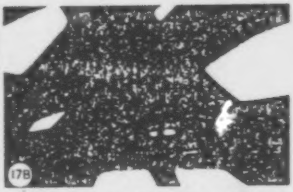
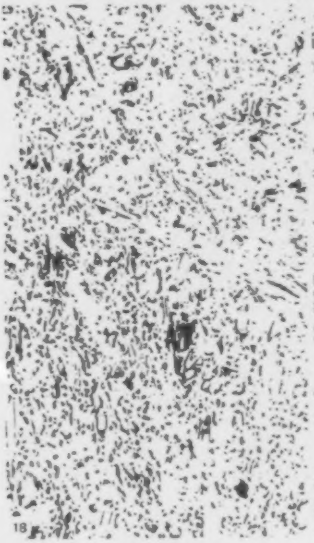




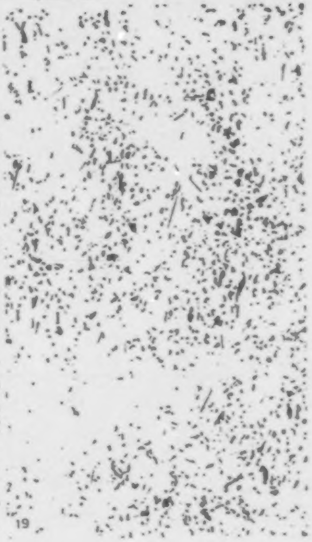
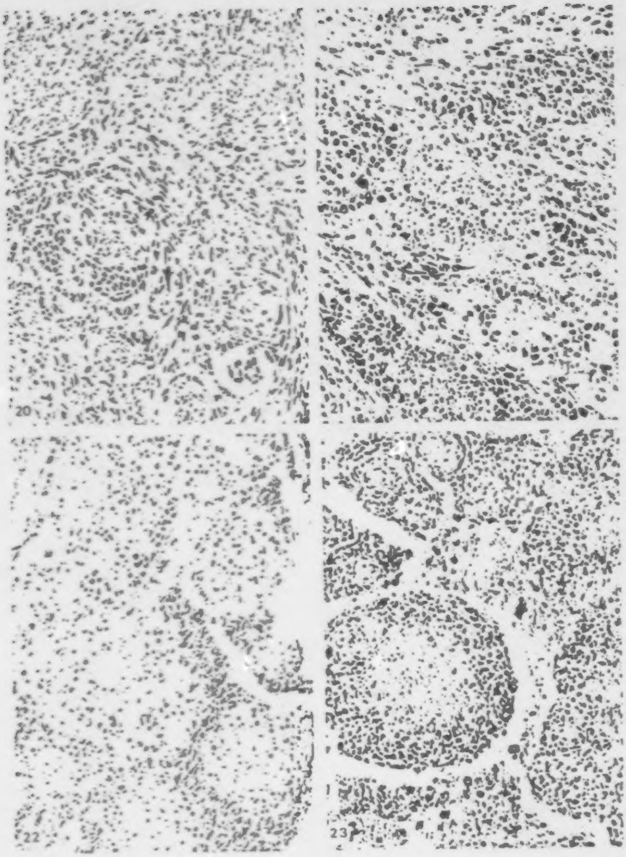


FIGURE 18.—Typical pleural response to noncarcinogenic glass fibers. Note phagocytic activity around large diameter [illegible] glass and minute particles of glass. From expt M68-#16. H & E. × 100

FIGURE 19.—Typical preneoplastic pleural response to carcinogenic glass fibers. Note numerous fine, long fibers in dense acellular matrix and patchy character of the granulomatous response. From expt K1-#2. H & E. × 100



Figures 20–23. Pleural sarcomas with characteristics that range from spindle to pleomorphic to tubulopapillary epithelial cell patterns. See also (1) and (2). Figure 23 is a papillary pleural implant from pleural sarcoma of contralateral pleura composed predominantly of spindle cells. H & E × 100.

Mortality in the Chrysotile Asbestos Mines and Mills of Quebec

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Of 11,788 persons born between 1891 and 1920 employed in the Quebec asbestos mining industry, 88.4% were traced. Of these 2,457 (23.6%) had died. Exposure indexes for each worker were calculated from job dust levels and duration of employment. The overall mortality was lower than expected for the population of Quebec but in the highest dust category, comprising 5% of the cohort, the age-standardized rate was 20% higher than in the other groups. Respiratory, cardiovascular, and malignant disease in equal proportions accounted for the excess. There were 101 deaths from respiratory cancer including three from malignant mesothelioma, an estimated excess of about 15 deaths. The difference in rates for respiratory cancer between those maximally and minimally exposed was fivefold and, though perhaps exaggerated, was apparently determined by accumulated dust exposure and duration of employment.

THE REMARKABLE qualities of the asbestos group of fibrous minerals have been recognized since antiquity, but mining and milling on an industrial scale began only at the end of the 19th century. In the Eastern Townships region of Quebec, deposits of chrysotile asbestos in serpentine rock were noted in the 1847 Canadian Geological Survey. The first mine was opened at Thetford in 1878, and within 30 years the region was producing most of the world's asbestos. The proportion fell as Russian, South African, and Italian mines came into operation, but Quebec still produces about 40% of the world's supply, now estimated at about 4 million tons a year.[1]

There are two main mining areas, one at Thetford Mines and neighboring towns of Black Lake and Broughton, and the other at Asbestos. The Thetford area was developed by many different companies, but with amalgamation the number has now been reduced to six. At Asbestos, the mining has been carried out since 1882 by one large company which also operates a small factory in the town for the manufacture of mixed asbestos products. There is a small mine owned by another company a few miles away.

Concern for the health effects of asbestos has paralleled growth in its production, and the main available evidence was reviewed fully by Wright[2] in 1969. The first cases of diffuse pulmonary fibrosis after prolonged exposure were noted by Murray in 1907, and by 1930 asbestosis was recognized as an important occupational hazard. Controls introduced since then have reduced considerably the dust concentration to which workers in the mines, mills, and primary manufac-

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turing industries are exposed. Though the prevention of asbestosis is far from complete in these industries, it is still generally believed that this can be achieved by more strict environmental control. Another aspect of the problem appeared in 1947 when Merewether[3] showed a link between asbestos exposure and lung cancer. The potential extent of this hazard was increased by reports of Wagner and others[4] during the last ten years that malignant tumors of the pleura and peritoneum are related to certain types of industrial work and perhaps also to neighborhood exposure.

The association between lung cancer and asbestos was first found in the British textile industry. Merewether's inquiry showed an unduly high proportion of lung cancers at autopsy in cases of asbestosis, and other observations among textile workers have confirmed the association.[5-8] Two studies in particular which take some account of the degree of exposure suggest a dose-response relationship. Knox et al[6] found a considerable excess of lung cancer in persons exposed before 1933 when asbestos control regulations were enforced, but none in persons exposed for ten years or more in the most dusty areas since then. These findings must be reviewed when a longer period of observation has elapsed, since Newhouse[8] (also in a textile factory) found an excess of lung cancer in persons heavily exposed 20 years earlier for periods of less than two years. Workers exposed to light or moderate dust concentrations showed no excess of bronchogenic cancer even after 20 years of exposure.

Selikoff and his colleagues[9] found an eightfold increase in lung cancer compared with national figures in a cohort study among the members of an American insulation workers union who had been exposed for 20 years or more. He also found a gross excess of pleural and peritoneal mesotheliomas. On the other hand, in a national survey of all known mesothelial tumors in Canada, 1960 to 1968, McDonald and her colleagues[10] found a history of occupational contact with asbestos in a relatively small proportion of cases. This exposure was mainly in insulation and allied trades, rather than in the asbestos-producing industry.

Of the four main types of asbestos fiber—chrysotile, crocidolite, amosite, and anthophyllite, the two textile factories referred to above[6,8] used mainly chrysotile fiber, together with some crocidolite, and in one of the two, some amosite. As in most industrial applications different types of fibers are mixed, the carcinogenic effects of a single fiber type in practice can only be studied in mining and milling. Chrysotile fiber is of greatest importance because of its qualities and extensive usage. The only studies of lung cancer in chrysotile miners and millers were reported by Braun and Truan in 1958[11] and by Kogan et al in 1966.[12] In the first of these, nine deaths from lung cancer were observed in the Quebec industry compared with six expected from provincial rates. The second was in the Soviet Union and showed that compared with the general population the mortality from lung cancer was increased by a factor of 1.9 for miners, 3.1 for millers, and 2.3 for factory workers. The present investigation forms part of a comprehensive epidemiological survey of the entire Quebec asbestos-producing industry since its inception. Using the considerable volume of data available, our primary aim has been to define as accurately as possible the quantitative relationship between exposure to chrysotile asbestos and the incidence of lung cancer. The results from parallel studies concerned with the relationship of dust exposure to radiographic appearances, pulmonary function, and respiratory symptoms will be reported separately.

Materials and Methods

Registration.—A register was compiled in the personnel department of each asbestos mining company in the Eastern Townships region of Quebec listing all persons currently or previously employed, as of Nov 1, 1966. A card was made out for each employee on which was recorded his name, date of birth, address, and a detailed work history which included the department and mine, dates of starting and finishing, for every job, and all periods of leave.

In one of the 44 mining companies represented in our survey, the records of at least 560 persons had been destroyed. These were of ex-employees and others not transferred when ownership of the company changed in 1964. The work histories of a small number of older men who had been employed partly in this company and partly in others were also incomplete.

Table 1.—*Subjects of Study and Results of Tracing by Age and Sex*

Year of Birth	Persons M	Persons F	Persons Total	Traced M	Traced F	Traced Total	% Traced	Dead	% of Persons Traced
1891-1895	1,553	14	1,567	1,179	13	1,192	76.1	611	51.3
1896-1900	1,982	31	2,013	1,588	28	1,616	80.3	655	40.5
1901-1905	2,027	50	2,077	1,724	45	1,769	85.2	498	28.2
1906-1910	1,897	99	1,996	1,741	92	1,833	91.8	330	18.0
1911-1915	1,837	117	1,954	1,773	113	1,886	96.5	221	11.7
1916-1920	2,027	154	2,181	1,976	149	2,125	97.4	142	6.7
All	11,323	465	11,788	9,981	440	10,421	88.4	2,457	23.6

Table 2.—*Subjects of Study and Results of Tracing by Dust Index and Years of Employment*

Years		Dust Index <10	10-	100-	200-	400-	800-	All
<1	No.	3,043	654	38	3	0	0	3,738
	% traced	76.6	75.1	76.3	66.7	...	...	76.3
1-	No.	1,025	1,975	450	264	122	64	3,900
	% traced	86.3	88.6	89.3	90.5	91.0	90.6	88.3
10-	No.	55	1,117	566	522	432	255	2,947
	% traced	100.0	99.0	98.9	99.0	99.3	99.6	99.1
30-	No.	0	204	181	250	303	265	1,203
	% traced	...	100.0	100.0	100.0	100.0	99.6	99.9
All	No.	4,123	3,950	1,235	1,039	857	584	11,788
	% traced	79.9	89.9	94.9	97.0	98.4	98.6	88.4

There was of course some movement of labor from one mining company to another. This necessitated bringing together and matching the records of all the companies, to obtain complete work histories. In the course of tracing ex-employees, the matching process could often be confirmed or amended. In all, 27,669 men and women were registered, including 6,415 currently employed on Nov 1, 1966. Of this total, 1,089 persons had been employed by more than one company.

Using the occupational histories, a list was compiled of all named jobs in each company from the beginning of its operation. A description of each of the 13,346 jobs listed in this way was obtained from existing evaluation systems and by interviewing employees with long service. Jobs with several names but involving the same work and dust exposure were combined and the codes finally needed for classification thus reduced to 5,788. For each of these and for each year of operation, the average dust exposure was estimated on a 13-point scale. Throughout the industry in the dryers, crushers, and mills, the concentrations of dust at working places had been measured annually since 1949 by Maurice Lachance, Eng, and since 1946 by various investigators in the small factory. All measurements were made with either a midget impinger or Greenburg-Smith, impinger and recorded in millions of dust particles per cubic foot (mpcf). Levels of exposure in mining and maintenance jobs and in other operations where no dust measurements had been made were estimated by investigating present-day dust levels and adjusting these according to changes in operating procedure reported by mining and maintenance personnel. A full description of geological and environmental features and of the methods and results of dust measurement are to be published by G. W. Gibbs, MSc, and Mr. Lachance.

Before 1949, few dust measurements were recorded, and estimates of exposure for that period are, therefore, only approximate. Interviews with employees of long service enabled comparisons of dustiness to be made with conditions since 1949. The dates of installation or modification of dust control systems were also taken into account.

Duration of exposure for each person was expressed in years or fractions of years after subtraction of all periods of leave, and was corrected to a working week of 40 hours. A dust index was calculated for each employee by adding together the products of time spent on each job and estimated average dust concentration. For example, suppose the dust index for a man was 600; this might mean that he had worked for five years at 40 mpcf, 15 years at 20 mpcf, and 20 years at 5 mpcf (ie, 200 + 300 + 100). It would be useful if it could be assumed that an index of 600 were also equivalent to a working life of 40 years at 15 mpcf, but this would entail assumptions which may or may not be justified.

Selection of Cohort.—The study of mortality was based on employees in an age group thought likely to yield the most valuable information. The cohort selected comprised 11,788 persons born between 1891 and 1920 inclusive who had been employed for one calendar month or more. Those born after 1920 would have had periods of exposure well short of a working lifetime and would still not have reached an age of high mortality. Those born before 1891 would have been very difficult to trace, and, as mentioned above, some of their work histories were incomplete or missing. The selected cohort comprised among others 1,203 persons who had worked for 30 years or more, 3,738 who had worked for less than a year, and 1,080 who had worked for more than a year but whose job had not involved any appreciable exposure to dust. Thus, there was a substantial group with minimal exposure available for comparison with others who had been heavily exposed.

Tracing and Ascertainment.—The search for ex-employees was mainly initiated in the mining towns. Telephone or postal inquiries were made first to establish whether the person in question was alive or dead on Nov 1, 1966. If reported dead, the exact date and place was sought from relatives, friends, and parish registers. For those not traced by these means, a systematic search was made in the provincial death records and certificates, and about 200 persons were found in this way. In addition, a search on our behalf was made in the index of the Canadian Unemployment Insurance Commission for any person not found by means of local enquiries. The names of 598 persons were found who had registered or re-registered between 1964 and Nov 1, 1966, and 30 more had re-registered after that date. All 628 were presumed to be alive for the purpose of our study.

Information was obtained concerning 10,421 (88.4%) of the 11,788 persons in the cohort; 7,965 were still alive (including 2,484 currently employed) and 2,457 (23.6% of those traced) were reported dead. Copies of death certificates were obtained from Canadian Provincial and US State Registrars for 2,211 (90%) persons. For 59 more (2%), an acceptable cause of death was obtained by other means; 30 were accidental deaths in the mines or during active service with the armed forces and 29 were caused by disease. Twenty-two of the 29 had occurred before the introduction of death registration in Quebec in 1926, and the cause of death was stated by relatives. In the other seven, the cause of death was obtained from a reliable source. A death certificate could not be obtained for the remaining 187; 47 had occurred before 1926, and 100 were deaths outside Quebec, mostly outside Canada. The cause of death was coded according to the Seventh Revision of the International Classification of Disease (ICD [World Health Organization, Geneva, 1957]). This was done by senior coder of the Department of Demography of Quebec who had recently retired.

The proportion of subjects traced by age, sex, and category of exposure is shown in Tables 1 and 2. Success in tracing depended mainly on duration of employment; 94% of those employed for one year or more and over 99% of all those employed for ten years or more were traced. Information was least satisfactory in persons born before 1900 and in those employed for less than one year. The principal reasons for failure were (1) no relative or friend could be located in the neighborhood and (2) insufficient identifying information, which would have enabled us to make a request to the Unemployment Insurance Commission or to locate a death certificate in Quebec. There were no other obvious reasons for bias towards discovering the living or the dead, but those traced dead or alive are likely to have been long-term rather than transient residents.

Diagnosis of Lung Cancer.—To make our figures for lung cancer as accurate as possible, we investigated and reviewed all certified cases and searched also for cases not described as such on the death certificate. Of 95 deaths coded as due to lung cancer (ICD 162 and 163), one was certified as due to a hydronephroma and another as due to pulmonary fibrosis, both of which had been coded incorrectly. Inquiries about the remaining 93 cases were made from hospitals, physicians, and pathologists, and information was received in 76. In five of these it was reported that there had been an autopsy, but we were unable to obtain pathological details. In another five, though the diagnosis had been made in the hospital, no clinical or pathological record was found. Seventeen more had been certified by family physicians but we did not succeed in finding out where and how the diagnosis had been made.

In the remaining 48 cases, pathological reports were obtained, 25 at autopsy and 23 at biopsy. A diagnosis of carcinoma of the trachea was made in one, of bronchus or lung in 44, and of malignant mesothelioma of pleura in two. In one case the histology was that of a melanosarcoma, and the pulmonary tumor was thought to be metastatic. Thus, of 95 certified cases, three had been included incorrectly, 47 were confirmed pathologically, 28 hospital diagnoses were presumed correct, and in 17 no further information was obtained.

The following steps were taken to discover cases of lung cancer that had not been mentioned as such on the death certificate:

1. A letter was sent to the certifying physicians whenever it was stated that an autopsy had been or would be performed. These numbered 306 in all; 33 deaths were certified as due to lung cancer and 273, as due to other causes. In 18 replies, it was stated that there had been no autopsy; in 175, that the certified diagnosis was confirmed at autopsy; and in 18, that it was incorrect. These 18 yielded five additional cases of lung cancer. The diagnoses for these had been certified as renal tumor (ICD 180), infectious hepatitis (ICD 092), pulmonary fibrosis (ICD 519), diabetes (ICD 260), and asbestosis (ICD 523).

2. We asked the physicians in charge of the industrial clinics at Thetford Mines and Asbestos for lists of all deaths known to be due to lung cancer. Their records included only employees who had given up work because of ill health, those who were pensioned, and those who had applied for workmen's compensation. They listed 24 of the 96 lung cancer deaths found by the methods already described plus three additional cases. These three deaths had been certified as due to tuberculosis (ICD 019), asbestosis (ICD 523), and coronary heart disease (ICD 420), and though there had been autopsies for the purpose of compensation, no mention of this was made on the death certificate. In addition, there were three autopsies for compensation purposes in which a small lung cancer was noted as an incidental finding. The pathologist had not considered these cancers to have contributed to death and the causes certified were asbestosis (ICD 523) in two cases and cardiac infarction (ICD 420) in a third.

3. A search was made for any case of primary malignant mesothelial tumor of the pleura that might have been given a code other than 162. One additional case coded as a benign pleural tumor was found.

4. We reviewed cases reported by pathologists in the national survey of primary malignant mesothelial tumors in Canada between 1960 and 1968, and five were in men who had worked in the Quebec asbestos-producing industry. Two were born in 1922 and were, therefore, not in our cohort, and two died in 1967 after the present study had ended. A fifth case, diagnosed by biopsy, was eligible for both studies.

To summarize the results of all these inquiries, three cases were removed from the group of 95 malignant neoplasms of the bronchus, trachea, or lung (ICD 162 and 163) and nine were added, making 101 in all (100 men and one woman). Included in the total were the following: cancer of the trachea, in one case; malignant mesothelial tumor, in three; and cancer of the bronchus or lung, in 97.

Results

Female Mortality.—There were only 465 women in the cohort; almost all had short exposures and all but 33 were in the two lowest dust-index categories. In all, 440 (94.6%) were traced, and of those, 45 had died. Tuberculosis (11), malignant neoplasms (12), circulatory (nine) and respiratory (one) diseases, and trauma (one) were the causes of death in 34. Death was due to other causes in eight cases, and the cause of death was unknown in two; there was one death from lung cancer. Apart, perhaps, from tuberculosis, these figures are not unusual and will not be considered further.

Male Mortality.—To permit comparisons of mortality by dust index and years of exposure, death rates were calculated in five-year cohorts by date of birth. Equivalent average death rates[13] were then calculated using a standard population with equal numbers in each age group. Since the actual number at risk in each cohort was similar, this method of age standardization was particularly appropriate. The standardized rates are shown by dust index and main disease groupings in Table 3. In the lower five dust categories, equivalent average death rates for "all causes" were approximately the same, but in the top category, containing 5% of the total cohort, mortality was about 20% higher than the rest. Malignant neoplasms, circulatory diseases, and respiratory diseases, in approximately equal proportions, accounted for the excess. Two groups showed the opposite trend: "trauma," probably because rates fell with advancing age, and "unknown causes," probably because death certificates were difficult to find for older men with short periods of employment.

Table 4 shows that the main contribution to the excess in malignant disease was from cancer of the bronchus, trachea, and lung

Table 3.—Equivalent Average Death Rates per 1,000 Men by Dust Index

	Dust index						
	<10	10-	100-	200-	400-	800-	All
No. of men	3,006	3,408	1,148	1,002	842	575	9,981
Tuberculosis (ICD 001-019)	18.6	19.9	31.6	23.8	28.5	25.8	22.5
Malignant neoplasms (ICD 140-209)	38.8	39.3	32.2	27.5	45.1	61.8	38.6
Circulatory diseases (ICD 400-469)	85.0	80.8	82.5	83.5	94.8	107.3	85.8
Respiratory diseases (ICD 470-529)	9.5	15.3	19.5	16.7	15.3	41.6	15.6
Trauma (ICD 800-999)	34.7	30.8	36.3	35.2	33.8	13.7	31.5
Other causes	46.8	52.9	39.0	47.7	38.3	58.9	48.4
Unknown causes	30.6	21.4	16.5	6.2	7.2	3.4	20.8
All causes	264.1	260.4	257.6	240.6	262.9	312.5	263.1

Table 4.—Equivalent Average Death Rates per 1,000 Men for Malignant Neoplasms (ICD 140-209) by Dust Index

	Dust index						
Location	<10	10-	100-	200-	400-	800-	All
Esophagus & stomach (ICD 150-151)	10.2 (32)	4.5 (13)	1.7 (2)	7.0 (5)	11.3 (8)	13.7 (8)	7.5 (68)
Intestine & rectum (ICD 152-154)	2.5 (8)	4.9 (15)	3.2 (3)	3.9 (3)	5.6 (4)	8.7 (5)	4.0 (38)
Other abdominal areas (ICD 155-159)	4.0 (13)	3.0 (9)	1.7 (1)	1.3 (1)	2.8 (2)	1.7 (1)	2.9 (27)
Bronchus, trachea & lung (ICD 162-163)	7.6 (25)	8.6 (26)	11.2 (10)	8.9 (8)	15.8 (11)	24.2 (14)	9.9 (94)
Other malignant neoplasms	14.4 (47)	18.6 (54)	14.5 (11)	6.4 (5)	9.5 (6)	13.5 (8)	14.4 (131)
All malignant neoplasms (ICD 140-209)	38.8 (125)	39.3 (117)	32.2 (27)	27.5 (22)	45.1 (31)	61.8 (36)	38.6 (358)

(ICD 162 and 163). In this group there was little difference between rates in the four lower dust categories, but the fifth and sixth groups showed an upward trend. A similar trend with years of exposure was found (Table 5), but the figures within the body of the table suggest a closer relationship with dust than with years. Subtraction of the three incorrectly coded cases and addition of the nine lung cancer cases found at autopsy increased slightly the rate among persons with highest dust and longest exposure, but did not materially change the picture (Table 5). Further analyses to distinguish better the relative importance of years of exposure and dust index are described as follows.

Rates for cancer of the intestine were about one third of those for cancers of the bronchus, trachea, and lung, but showed a very similar trend. Rates for cancer of the esophagus and stomach, on the other hand, did not appear related to dust in any consistent manner. Other abdominal neoplasms were less frequent still and also unrelated to dust. This is important since it might be expected that unrecognized peritoneal mesotheliomas would be found within this group.

Most of the excess mortality from respiratory disease was ascribed to pneumoconiosis (Table 6). There was little evidence that dust-associated deaths were included in other respiratory categories. Of the 28 deaths coded under the pneumoconioses, one was described as anthracosis, four as silicosis, and the remaining 23 as asbestosis. The greatest excess mortality from pneumoconiosis was among persons in the highest dust group who had been employed between ten and 29 years.

In the circulatory diseases group, there was also excess mortality in the highest two dust categories, mainly in persons employed between ten and 29 years. It was present equally in the "arteriosclerotic and degenerative heart disease" group (ICD 420 to 422 [which included more than three quarters of all circulatory deaths]) and in the group of "other circulatory diseases" (ICD 400 to 419 and 423 to 469).

Table 5.—*Equivalent Average Death Rates per 1,000 Men for Cancer of Bronchus, Trachea, and Lung**

Years	Dust Index <10	10-	100-	200-	400-	800-	All
As certified							
<1	6.4 (16)	1.7 (1)	27.8 (1)	0.0 (0)	...	...	5.9 (18)
1-	11.7 (9)	9.5 (15)	11.3 (4)	5.8 (1)	7.6 (1)	0.0 (0)	9.6 (30)
10-	0.0 (0)	12.4 (7)	6.7 (3)	5.3 (3)	19.9 (6)	23.6 (6)	13.1 (25)
30-	...	12.5 (3)	14.7 (2)	13.9 (4)	16.1 (4)	27.9 (8)	17.2 (21)
All	7.6 (25)	8.6 (26)	11.2 (10)	8.9 (8)	15.8 (11)	24.2 (14)	9.9 (94)
Using all available information							
<1	6.7 (17)	1.7 (1)	0.0 (0)	0.0 (0)	...	...	5.9 (18)
1-	12.0 (9)	10.1 (16)	9.4 (3)	11.5 (2)	7.6 (1)	0.0 (0)	10.1 (31)
10-	0.0 (0)	12.8 (8)	7.6 (4)	9.2 (4)	19.9 (6)	23.6 (6)	14.3 (28)
30-	...	12.5 (3)	14.7 (2)	13.9 (4)	16.1 (4)	35.3 (10)	19.1 (23)
All	7.8 (26)	9.1 (28)	10.1 (9)	10.6 (10)	15.8 (11)	27.7 (16)	10.6 (100)

* By dust index and years of employment. Diagnosis was ICD 162 and 163.

Comparison With Quebec Mortality.—The number of deaths from all causes which would have been expected if Quebec death rates had applied was calculated in the following way. Age-specific death rates for the province were applied for each year, 1950 to 1966, to all the men traced who were alive in 1950, with an adjustment for those who started work after 1950. The expected number of deaths among men, thus, was 1,824, whereas the observed number in the cohort was 1,674.

A similar calculation was made for lung cancer deaths. The expected number was 91, whereas 94 male deaths certified as due to this cause were observed. Correction for coding errors and additional autopsy information was not appropriate, since certificates for the general population were uncorrected.

In the six counties of the province which include the mining region (Arthabaska, Beauce, Drummond, Megantic, Richmond, and Wolfe), the lung cancer death rate was about two-thirds the provincial rate and the expected number of deaths was correspondingly lower. However, many ex-employees were no longer living in this area when they died, and most of those who had moved had gone to cities where lung cancer death rates were higher. The best estimate of expected deaths probably lies between the numbers 61, derived from the mining region, and 91, from the province. The excess of observed over expected lung cancer deaths, therefore, lies somewhere between zero and 30 and is most probably between ten and 20.

Factor Evaluation.—Although the numbers of men in each cohort were about the same, their distribution by years of employment and dust index was uneven. In these circumstances, equivalent average death rates could be misleading. Berry[14] recently reviewed some of the methods used for analyzing the importance of factors in multiway tables and described a parametric approach which has the advantage that the adequacy of the model may be checked and statistical significance evaluated. From the number of deaths from any particular cause in groups subdivided by date of birth and year of employment or dust index, expected rates may be calculated assuming no interaction between age and the other two factors. For this analysis, the complementary log log transformation was used.[15] This transformation is appropriate when increasing exposure is associated with proportional increases in the age-specific death rates.

The results of this parametric analysis for respiratory cancer (Table 7) agree remarkably closely with the equivalent average death rates shown in the lower half of Table 5. The rates for the first five dust index levels do not differ significantly but those for the first four are significantly different from the highest exposure group. There are, however, also differences between the rates by years of employment, those for the lower two categories being significantly less than that for men with the longest exposure.

The general fit of the complementary log log model is very good. In no cell of the 24 does the observed number of deaths differ significantly from expectation. Tests for interaction between the 24 cells and the six cohorts gave the following results: likelihood

Table 6.—*Equivalent Average Death Rates per 1,000 Men for Respiratory Diseases (ICD 470-529) by Dust Index and Years of Employment*

Years	Dust Index						
	<10	10-	100-	200-	400-	800-	All
Pneumonia and bronchitis (ICD 490-509)							
<1	2.6(7)	8.7(4)	0 (0)	166.7(1)	...	...	4.0(12)
1-	7.1(5)	3.7(6)	2.5(1)	4.4(1)	15.5(2)	16.7(1)	5.2(16)
10-	0	6.3(4)	5.9(2)	5.3(3)	5.6(3)	9.8(2)	6.3(14)
30-	...	0	4.9(1)	5.8(1)	0 (0)	3.4(1)	2.9(3)
All	3.6(12)	4.7(14)	4.2(4)	6.6(6)	5.6(5)	6.9(4)	4.9(45)
Pneumoconioses (ICD 523 and 524)							
<1	1.4(3)	4.8(2)	0	0	...	...	1.9(5)
1-	1.4(1)	1.5(2)	0	5.8(1)	0	0	1.5(4)
10-	0	2.3(1)	0	1.2(1)	1.6(1)	34.3(8)	6.3(11)
30-	...	0	0	3.6(1)	7.1(2)	17.9(5)	6.9(8)
All	1.5(4)	2.0(5)	0(0)	3.7(3)	3.9(3)	22.6(13)	3.2(28)
Other respiratory diseases (ICD 470-489, 510-522, 525-529)							
<1	4.5(10)	5.7(3)	0	0	0	0	4.6(13)
1-	3.8(3)	13.2(20)	29.0(9)	9.8(2)	7.9(1)	13.9(1)	12.5(36)
10-	0	2.7(2)	9.2(2)	7.9(2)	11.0(3)	7.8(2)	7.3(11)
30-	...	0	0	0	0	13.5(4)	3.6(4)
All	4.2(13)	8.6(25)	15.3(11)	6.3(4)	5.9(4)	12.1(7)	7.5(64)
All respiratory diseases (ICD 470-529)							
<1	8.6(20)	18.8(9)	0	166.7(1)	...	...	10.5(30)
1-	12.2(9)	18.4(28)	31.5(10)	20.0(4)	23.5(3)	30.6(2)	19.2(56)
10-	0	11.2(7)	15.1(4)	14.4(6)	18.2(7)	51.6(12)	19.9(36)
30-	...	0	4.9(1)	9.3(2)	7.1(2)	34.7(10)	13.4(15)
All	9.5(29)	15.3(44)	19.5(15)	16.7(13)	15.3(12)	41.6(24)	15.6(137)

ratio test, 88.9 and χ^2, 90.4, each with 95 degrees of freedom; and $P > 0.5$.

Comment

At face value, the findings suggest that our cohort of workers in the chrysotile mining industry had a lower mortality than the population of Quebec of the same age. This is generally true of employed persons, provided they are not subjected to an occupational hazard sufficient to offset the considerable selective advantage of being and remaining fit for work. This advantage was clearly lost by the men in the highest dust-index category whose standardized mortality was about 20% above that of the rest. Two thirds of the excess mortality in this group was probably due to pulmonary fibrosis, shown on the death certificate as either asbestosis or in the guise of various respiratory or cardiovascular diagnoses, and the remaining third to cancer, mainly of the respiratory tract.

Table 7.—*Age-Corrected Death Rates per 1,000 Men for Cancer of the Bronchus, Trachea, and Lung by Dust Index and Years of Employment**

Years	Dust Index						
	<10	10-	100-	200-	400-	800-	All
<1	6.3	2.0	0.0	0.0	...	...	5.5
1-	11.4	9.4	8.1	8.3	9.6	0.0	9.5
10-	0.0	10.4	9.8	10.3	16.8	23.4	12.8
30-	...	13.3	9.9	14.6	13.7	34.4	17.9
All	7.5	8.7	8.9	11.0	14.6	26.3	10.0

* A complementary log log model was used, and diagnosis was based on all available information.

The high rate of lung cancer in men heavily exposed to asbestos might be explained if such men also tended to smoke more heavily than others. We have no direct evidence on this point for ex-employees, since information on smoking was not routinely recorded by the companies or the medical clinics. However, in a survey of a selected random sample of over 1,000 current employees there was little or no relationship, after allowing for age, between smoking habits and either dust exposure or duration of employment.

Our attempts to assess separately the importance of cumulative dust exposure and duration of exposure in relation to lung cancer are capable of more than one interpretation. As shown in Table 5, there is a fivefold difference between the mortality for those with the lowest amount and duration of exposure, 6.7, and that for those with the highest, 35.3. This is confirmed by the parametric analysis (Table 7) which further suggests that accumulated dust exposure and

Table 8.—Comparison of Mesothelial Tumor Findings in Two Previous Studies and the Present Study

	Selikoff et al[16]	Newhouse[8,17]	Present Study
No. of men studied	632	4,806	9,981
No. of deaths			
All causes	380	436	2,413
Lung cancer	72	42	97
Mesothelial tumors	22	20	3

duration of employment are about equally important in determining the difference. Unfortunately, there are possible sources of bias and error which may have contributed to both these effects.

In Table 5, the rates for men with less than one year of employment seem remarkably low; 18 deaths were observed, whereas 29 would have been expected on the basis of Quebec rates. It was in this group that tracing was least satisfactory (Table 2). Failure to ascertain even a small number of lung cancer deaths would have made an appreciable difference in the rates. Short-term employees who were traced tended to be those who had stayed in the neighborhoods where, in any case, lung cancer rates were much lower than in the urban areas of the province and elsewhere, to which those untraced may well have gone. Whatever the explanation, it is difficult to accept, without reserve, the low rate of lung cancer in this group.

A second source of error is related to the ascertainment of lung cancer as a cause of death. It is generally believed that this diagnosis is greatly aided by postmortem examination. In our study, 34% of the cases before correction and 40% after correction had had an autopsy, compared with 12% of all deaths. This might not matter if autopsies were evenly distributed in relation to exposure, but this was not so. The autopsy rates in ascending order of dust-index group were 11%, 11%, 9%, 10%, 16%, and 22%, and by years of employment, 12%, 9%, 17%, and 21%. This trend is also likely to have exaggerated the difference in lung cancer rates in relation to exposure, but by how much it is impossible to say.

Taking all these considerations into account we are inclined to conclude that the true difference between those maximally and minimally exposed may well be closer to threefold than fivefold and that this is partly dust-related and partly time-related. We propose in future analyses, when a longer period of observation will have yielded more data, to use an exposure index based on the concept of amount of dust inhaled and the time that it remains in the lung. Our findings so far appear compatible with such a model.

In the Canadian survey mentioned earlier,[10] primary malignant mesothelial tumors were rarely associated with chrysotile asbestos production in Quebec and the present survey bears this out. Three deaths from this cause were found among nearly 2,500 deaths from all causes in the cohort. This is probably more than would be expected in a comparable number of deaths in the general population, but quite out of line with the findings of Selikoff et al[16] in insulation workers and those of Newhouse[8,17] in a London asbestos factory. The magnitude of the difference can be inferred from the figures in Table 8. Though these figures are not entirely comparable, because of age, methods of ascertainment, or other factors, they suggest that the results of Newhouse[8,17] are similar to those of Selikoff et al[16] for mesothelial tumors and, perhaps, lung cancer. It is clear that the Quebec chrysotile workers have had nothing like the experiences of the American insulation workers or the London factory workers with respect to malignant mesothelioma, and it seems unlikely that they are compatible with respect to lung cancer. These findings strongly suggest either that chrysotile is less likely to cause malignant disease of the lung and pleura than other forms of asbestos, such as crocidolite, or that workers engaged in insulation and processing are exposed to additional factors which explain the difference.

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Paul M. Cartier, MD, medical director of the

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References

1. Asbestos: A review of the Canadian industry. *Mining in Canada*, Oct 1967, pp 17-38.

2. Wright GW: Asbestos and health in 1969. *Amer Rev Resp Dis* 100:467-479, 1969.

3. Merewether ERA: Asbestosis and carcinoma of the lung, in *Annual Report of the Chief Inspector of Factories for the Year 1947*. London, Her Majesty's Stationery Office, 1949, pp 79-87.

4. Wagner JC, Sleggs CA, Marchand P: Diffuse pleural mesothelioma and asbestos exposure in the North Western Cape Province. *Brit J Industr Med* 17:260-271, 1960.

5. Doll R: Mortality from lung cancer in asbestos workers. *Brit J Industr Med* 12:81-86, 1955.

6. Knox JF, Holmes S, Doll R, et al: Mortality from lung cancer and other causes among workers in an asbestos textile factory. *Brit J Industr Med* 25:293-303, 1968.

7. Enterline PE, Kendrick MA: Asbestos-dust exposures at various levels and mortality. *Arch Environ Health* 15:181-186, 1967.

8. Newhouse ML: A study of the mortality of workers in an asbestos factory. *Brit J Industr Med* 26:294-301, 1969.

9. Selikoff IJ, Hammond EC, Churg J: Asbestos exposure, smoking and neoplasia. *JAMA* 204:106-112, 1968.

10. McDonald AD, Harper A, El Attar OA, et al: Epidemiology of primary malignant mesothelial tumors in Canada. *Cancer* 26:914-919, 1970.

11. Braun DC, Truan TD: An epidemiological study of lung cancer in asbestos miners. *Arch Industr Health* 17:634-653, 1958.

12. Kogan FM, Troitsky SY, Gulevskaya MR: On the carcinogenic effect of asbestos dust. *Gig Tr Prof Zabol* 8:28-33, 1966.

13. Hill AB: *Principles of Medical Statistics*, ed 8. London, Lancet Ltd, 1966, p 209.

14. Berry G: Parametric analysis of disease incidences in multiway tables. *Biometrics* 26:572-579, 1970.

15. Yates F: The use of transformations and maximum likelihood in the analyses of quantal experiments involving two treatments. *Biometrika* 42:382-400, 1955.

16. Selikoff IJ, Hammond EC, Churg J: Mortality experiences of asbestos insulation workers, in *Proceedings of the International Conference on Pneumoconiosis Johannesburg, 1969*, to be published.

17. Newhouse ML, Wagner JC: Validation of death certificates in asbestos workers. *Brit J Industr Med* 26:302-307, 1969.

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Relationship between occupations and asbestos-fibre content of the lungs in patients with pleural mesothelioma, lung cancer, and other diseases

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Whitwell, F., Scott, Jean, and Grimshaw, Myra (1977). *Thorax*, **32**, 377-386. **Relationship between occupations and asbestos-fibre content of the lungs in patients with pleural mesothelioma, lung cancer, and other diseases.** The light-visible asbestos-fibre content of 300 lung specimens has been measured using a potash-digestion and phase-contrast microscopy technique, and the results have been correlated with the occupations of the patients.

Among 100 pleural mesothelioma specimens were 88 where the patients had been exposed to asbestos, and in 73 of these (83%) the lung tissue contained over 100 000 asbestos fibres per gram of dried lung, and only one specimen showed less than 20 000 fibres per gram. When asbestosis was present, the lungs nearly always showed over 3 million fibres per gram.

In 100 control lungs (those without industrial disease or lung cancer) there were less than 20 000 fibres per gram of dried lung in 71% of specimens. Lungs from 100 patients with lung cancer but no industrial disease contained less than 20 000 fibres per gram of dried lung in 80% of cases. Patients with parietal pleural plaques nearly all had over 20 000 fibres per gram in their lungs.

The number of asbestos fibres found in the lungs was closely related to the occupations of the patients but not to their home environment. Patients who had lived near likely sources of atmospheric asbestos pollution did not have higher asbestos fibre counts than the rest of the patients.

It is concluded that there is a definite dose relationship between asbestos exposure and mesothelioma formation but that 'sub-asbestosis' levels of asbestos exposure do not contribute to the formation of lung cancer in those not subjected to industrial asbestos exposure.

In 1960 a link between pleural mesothelioma and previous asbestos exposure was described by Wagner *et al.*, the degree of exposure usually having been insufficient to cause asbestosis, and acquired more often in the home than in the industrial environment. Shortly afterwards Thomson *et al.* (1963) reported that asbestos bodies were present in about 30% of adult lungs examined at necropsy from patients who had had no known industrial exposure.

Both these findings have been confirmed many times from different countries, with only slight modification. The asbestos exposure of patients with asbestos-induced mesotheliomas has usually come from industrial exposure, though a few cases have been reported where the only known asbestos hazard had been the home environment, contaminated by nearby industrial plants, work clothes, or even household articles containing asbestos (Newhouse and Thompson, 1965; Greenberg and Davies, 1974). The percentage of urban lungs containing asbestos bodies has been found to be much higher than in the original series examined, sometimes over 90% (Utidjian *et al.*, 1968), largely due to more elaborate methods of extracting asbestos bodies from lungs.

Another possible effect of 'sub-asbestosis' levels of asbestos exposure is an enhancement of the carcinogenic effect of cigarette smoking in inducing lung cancer, as suggested by Selikoff *et al.*

(1973) from surveys of large numbers of insulation workers in the United States. Their view has been supported by Warnock and Churg (1975), who found that in a community free from industrial asbestos exposure lung cancer patients had significantly more asbestos bodies in their lungs than were found in control patients without lung cancer from the same community.

The shortcomings of many studies have been the inadequacy of occupational histories of patients, the crude methods of assessing from the lungs the degree of previous asbestos exposure, and often the absence of postmortem confirmation of the nature of tumours. The early work on the link between asbestos exposure and mesothelioma naturally relied upon retrospective studies in which case records contained little information about occupation and often little or no lung tissue had been preserved. A similar dearth of histological evidence confuses the possible link between 'sub-asbestosis' asbestos exposure and lung cancer.

The present study is an analysis of the asbestos-fibre content of the lungs from 100 pleural mesothelioma patients, 100 control patients (who had died from conditions other than industrial lung disease or lung cancer), and 100 lung cancer patients who did not have industrial lung disease. In nearly all patients occupational histories have been taken in some detail, and in many cases residential histories have also been obtained. The work began as an attempt to find out which pleural mesotheliomas were induced by asbestos and which were spontaneous tumours, and was later extended to study a normal control series and patients with lung cancer.

Methods of the investigation

HISTORY TAKING

Mesothelioma series

Over half the patients died in Merseyside hospitals, many in Broadgreen Hospital. Often those who died in other Merseyside hospitals had previously been investigated in Broadgreen Hospital. In these cases detailed occupational, residential, and family histories were taken covering possible asbestos exposure during the whole of the patients' lives. Though these were usually easily obtained, cases occurred where the exposure had been for only a few months over half a century ago, likely to be overlooked by the patients unless questioned closely, and often quite unknown to relatives. Considerable patience and a knowledge of the past uses of asbestos were needed in obtaining some histories, but unless the information is obtained from the patients it becomes lost as the relevant asbestos exposure often happened before surviving relatives were born.

For other patients in this series similar information was sought from patients or their relatives by the staff of the hospitals where the patients were treated, or by the medical staff of the Manchester Pneumoconiosis Medical Panel.

Normal control series

The usual inadequacies of occupational histories in hospital case-records made this the most difficult series to collect, and it proved difficult to arrange interviews with relatives after patients had died. Although there are over 600 postmortem examinations per year in the hospital it took about six months to collect the first 50 cases with adequate occupational histories. The problem was solved with the help of the Merseyside coroner, who permitted his staff to complete a questionnaire about jobs and residences for each patient when interviewing relatives for other purposes. The second half of this series therefore consists of those brought dead into the hospital.

Lung cancer series

These patients provided the fullest histories as they were all patients in the Cardiothoracic Surgical Centre at Broadgreen Hospital being treated by pneumonectomy or lobectomy for lung cancer. One week after operation they were interviewed by one of us (MG) when notes were made of all occupations, residences, hobbies, occupations of close relatives, and smoking histories. In order not to alarm the patients the interviews were carried out with all surgical patients, not just those with lung cancer. The only patients not interviewed after pneumonectomy or lobectomy were those who died early in the postoperative period, and a few who were quickly transferred to another hospital because their lesions proved to be tuberculous.

MATERIAL OF THE STUDY

Mesothelioma series

The series comprised 100 consecutive pleural mesothelioma lung specimens, obtained at necropsy, which had been submitted to the Manchester Pneumoconiosis Medical Panel by coroners in north-west England between 1973 and 1976. The specimens had been fixed in formalin, in most cases by its injection into the bronchial tree to inflate the lungs. Eighteen patients had died in Broadgreen Hospital, 37 patients were from other

Merseyside hospitals, and 45 patients were from other parts of north-west England.

Normal control series

The normal control series consisted of Broadgreen Hospital patients in 1975 and 1976 who were over 20 years of age at necropsy, had neither industrial lung disease nor lung cancer, and had a lower lobe of lung free of pneumonia or infarction. This lobe was then inflated with formol saline through the bronchial tree. Where an adequate occupational history had been obtained the lobe was used for asbestos-fibre analysis. From August 1976 only lungs from coroner's necropsies were used. Apart from being selected by the availability of an occupational history, and later cases being those referred from the coroner, the specimens formed a consecutive series until 80 had been examined. From that time only lobes from male patients between 50 years and 70 years of age were used, in order to avoid excessive imbalance of the sex and age distribution in the three series (Table 1).

Lung cancer series

This consisted of 100 lungs or lobes removed surgically at Broadgreen Hospital in 1975 and 1976 because they had contained lung cancers. They were consecutive specimens, except for the omission of some specimens with insufficient normal lung tissue due to the size of the tumour or because of secondary lung changes. Also, cases were omitted when the patient died before an adequate history had been obtained. The specimens were fixed either in the operating theatre by formalin injection through the bronchial tree, or later in the pathology department.

TISSUE STUDIES OF EFFECTS OF ASBESTOS EXPOSURE

In the mesothelioma and normal control series the parietal pleura was examined at necropsy for collagenous plaques. The necropsy reports of pathologists submitting mesothelioma specimens to the Pneumoconiosis Medical Panel often commented on the presence or absence of pleural plaques. In the lung cancer series the surgeons usually did not see or comment on pleural plaques, though these were often found at necropsy in patients who had died after operation.

In all cases the lungs were examined macroscopically for asbestosis and microscopically for asbestosis and asbestos bodies. In addition to routine sections, thick unstained sections were examined in many specimens.

In the mesothelioma series lung juice smears were prepared using a method already described (Whitwell and Rawcliffe, 1971), and the numbers of asbestos bodies on slides were counted. When unfixed lung tissue was used in making these preparations the results provided a roughly quantitative assessment of previous asbestos exposure. When the preparations had to be made from fixed lung tissues far fewer asbestos bodies were seen and it was not possible to correlate the findings with previous asbestos exposure.

As most of the specimens examined were already fixed, a more reliable indicator of asbestos exposure was sought.

Asbestos-fibre counts on lung tissue

Because of the limitations of the previous technique, it was decided to count the asbestos fibres, coated and uncoated, which could be extracted from lung tissue. Ideally, one would wish to count all fibres, including those too fine to be seen by light microscopy, but this was beyond our resources. However, it has been stated that the ratio of light-visible fibres to total fibres is fairly constant (Timbrell, 1973; Ashcroft and Heppleston, 1973) so it was thought worth while to count the light-visible fibres.

In 1968 Gold evolved a method of counting asbestos fibres in lung tissue by macerating a known weight of dried lung tissue in potash, washing the digestion mixture three times in distilled water, and counting the fibres in an aliquot of the suspension in a Fuchs-Rosenthal chamber. We used this method in 1972 but found few fibres, and the results were difficult to reproduce with consistency. Ashcroft and Heppleston (1973) improved the method, largely by reducing the washings of the deposit to one, using wet lung tissue with

Table 1 *Sex and age distribution of the three series*

Series	Sex		Age (years)						
	M	F	20-29	30-39	40-49	50-59	60-69	70-79	80-89
Mesothelioma	86	14	1	1	5	29	40	22	0
Control	72	28	1	6	12	25	27	30	8
Lung cancer	78	22	0	1	9	29	44	8	0

calculation of the equivalent dry weight, and using phase-contrast microscopy. These workers could see finer fibres and also more fibres than were seen by Gold's method, counting fibres of about 3 μ in length or 0·4 μ diameter, whereas by Gold's method it was difficult to see fibres of less than about 12 μ in length.

Since the end of 1972, and for the whole of the present investigations, we have followed the method of Ashcroft and Heppleston, except that we count only fibres over 6 μ in length, as smaller fibres can be confused with bacteria. Coated and uncoated fibres are counted together. Although the method sounds crude, the results are reproducible with a coefficient of variance of about 7% (Table 2). More variation can arise through the selection of lung tissue than in the actual counting, and with all specimens we have used the base of the more normal lower lobe, just above the diaphragmatic pleural membrane, except with upper lobe carcinoma specimens where we have used the lower part of the upper lobe. The fibres counted are nearly always amphibole asbestos, as it is very difficult to see the finer crysotile fibres.

Before using this test routinely familiarisation with the appearances of different asbestos fibres in digestion mixtures in counting chambers was gained by studying digested normal lung tissues which had been fixed with formol saline containing UICC asbestos samples.

In the following text, where numbers of fibres are mentioned, the figure refers to fibres per gram dried lung, usually from the base of a lower lobe.

Table 2 *Ten asbestos-fibre counts on one digestion mixture*

Count	*Number counted*	*Fibres per gram dried lung*
1	175	328 000
2	168	315 000
3	159	298 000
4	145	272 000
5	162	304 000
6	160	300 000
7	139	261 000
8	146	274 000
9	157	295 000
10	161	302 000

Mean 295 000
SD 20 500
Coeff of variance 6·95%

Results

MESOTHELIOMA SERIES

The range of asbestos fibres per gram of dried lung found in the base of the lower lobe in the specimens ranged from nil to 70 million, as shown in Fig. 1, which also indicates the relevant occupation of each patient, except for five patients whose history was unknown. When patients had followed more than one occupation that carried an asbestos

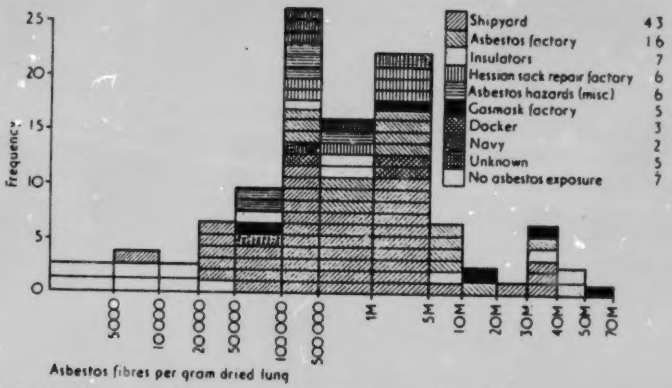

Fig. 1 *Asbestos fibre content and occupations of 100 pleural mesothelioma patients.*

exposure risk the more hazardous one was used in the classification; for example, several shipyard workers had previously been in the Navy.

There were 88 cases with a history of asbestos exposure, and in all but one of these the lungs showed over 20 000 fibres. The one patient with probable asbestos exposure and fewer fibres was a man aged 79 years who, between the ages of 15 and 31 years, had been a plumber in a shipyard, afterwards becoming an office clerk. No pleural plaques were found at necropsy. Seventy-three patients (83%) with a history of asbestos exposure had over 100 000 fibres, and in 23 of these patients (26%) there was some histological asbestosis. Most of the lungs showing asbestosis contained over 3 million asbestos fibres, and the numbers of asbestos fibres present corresponded roughly with the degree of asbestosis (Table 3). Asbestosis was present in over half the patients who had worked in asbestos factories or gas-mask factories but in less than one-fifth of patients who had worked in shipyards or sack-repair factories.

Table 3 *Asbestos fibre counts in millions per gram dried lung in 23 of the 100 mesotheliomas which showed some asbestosis*

	Asbestosis		
	Mild	*Moderate*	*Severe*
	1.0	2.0	6.5
	1.4	4.6	18
	3.3	5.5	23
	3.3	8.0	46
	3.3	10	57
	6.0	17	70
	8.0	24	
	21	44	
	23		
Arithmetic mean	8	14	37
Geometric mean	4.7	9.6	28

The patients who had worked in gas-mask and sack-repair factories form an interesting group, being among the few who had worked for only a brief period in a hazardous environment, usually during the first or second world war, and had otherwise been housewives. The residual asbestos fibre count found in some of these patients' lungs is given in Table 4, showing that 60 years after an asbestos exposure of less than one year's duration which had been insufficient to cause asbestosis, the lung retained over half a million asbestos fibres. The gas-mask case listed in Fig. 1 with between 50 000 and 100 000 fibres is the only home environment asbestos-induced mesothelioma in the series, being the son of a worker from a gas-mask factory where the workers took crocidolite home to pack into canisters.

The seven patients with no credible history of asbestos exposure were three housewives, a farmer, a fireman, a clerk, and a crankshaft fitter. Pleural plaques were not noted in any of their necropsy reports, all had under 40 000 asbestos fibres, six being less than 20 000 fibres, and no fibres were seen in two cases. These cases must be spontaneous pleural mesotheliomas.

NORMAL CONTROL SERIES

The commonest causes of death in this series were ischaemic heart disease in 48%, malignancy in 10%, and pulmonary embolus in 7%. The high frequency of heart disease was due to the inclusion of many coroner's cases.

No asbestosis or excess asbestos bodies were found in the routine histological studies.

Bilateral pleural plaques were seen in 21 cases, all male.

The asbestos-fibre counts of this series are shown in Fig. 2, 57% having less than 10 000 fibres and 71% having less than 20 000 fibres. Thirty-five per cent of male patients, but only 14% of female patients, had over 20 000 fibres.

Nearly all the patients had lived the greater part of their lives in Liverpool but it was not possible to assess any influence of home environment on the asbestos-fibre levels. However, the jobs of the 10 patients with the highest and lowest counts in the series (Table 5) suggest that the patients' work is largely responsible for the amount of asbestos in the lungs. The 10 patients with the lowest

Table 4 *Limited asbestos exposure in housewives leading to mesothelioma*

Age at death (yr)	*Work*	*Duration of work (yr)*	*Interval between first exposure and death (yr)*	*Asbestos fibre count*
74	Sackware factory	1	60	287 000
78	,,	1	60	550 000
59	,,	2	30	300 000
47	,,	1	30	1 300 000
55	Gasmask factory	5	30	57 000 000
61	,,	4	33	23 000 000
57	,,	0.5	30	17 000 000
69	,,	0.5	15	1 600 000

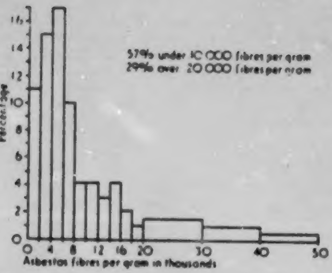

Fig. 2 *Asbestos fibre content of normal control series (15 highest not shown in figure).*

counts had little or no contact with asbestos at work, whereas the 10 patients with the highest counts were in occupations associated with asbestos exposure.

Pleural plaques were present in 55% of the patients with over 20 000 fibres per gram, but in only 5·5% of those with fewer fibres.

LUNG CANCER SERIES

The histological cell-types of the tumours in this series are shown in Table 6, together with the smoking habits of patients with tumours of the commoner cell-types. The overall frequency of cigarette smoking in the series was 83%, 67% of patients smoking over 15 cigarettes per day.

Table 6 *Cell type frequency and smoking habits of lung cancer patients*

Type	*Frequency (%)*	*% Cigarette smokers*	*% Over 10 cigs per day*
Squamous	52	88	73
Oat-cell	16	87	62
Adenocarcinoma and malignant adenomatosis	17	76	59
Carcinoma simplex	9		
Adenosquamous	4		
Giant-cell	2		

None of the patients had a history of industrial lung disease and routine histological sections showed no asbestosis in any cases; only occasional asbestos bodies were present.

The asbestos-fibre content of the series is shown in Fig. 3, and it is very similar to that of the control series. Fifty-seven per cent of patients had less than 10 000 fibres and 80% had less than 20 000 fibres.

The occupations and homes of the 10 patients with the lowest asbestos-fibre counts are shown in Table 7. All the occupations are traditional jobs which do not involve the use of asbestos. Six of these patients had lived their lives in industrial cities, although 22% of patients in the lung cancer series had lived in rural Wales, Cheshire, Lancashire or the Isle of Man.

Table 5 *Occupations and homes of 10 patients in control series with the lowest and highest asbestos fibre counts*

Low counts		*High counts*	
Number	*Job*	*Number*	*Job*
0	Tailoress	521 000	Docker
0	Housewife	109 000	Joiner, french polisher
0	Housewife	145 000	Merchant navy
0	Grocer	285 000	Ship repairer
0	Lorry driver	109 000	Painter, building site scaffolder
0	Dance-hall manager, BTS driver	245 000	Bricklayer
1400	Tea inspector, medical orderly	103 000	Roof repairer
2100	Office clerk	149 000	Coal merchant
2400	Food packer in factory	76 500	Docker, merchant navy
2600	Bookbinder	56 000	Fitter's labourer at chemical works

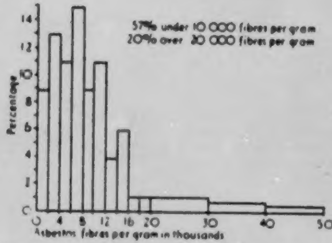

Fig. 3 *Asbestos fibre content of lung cancer series (9 highest not shown in figure).*

The occupations of the 10 patients with the highest counts are shown in Table 8, and the jobs are similar to those of subjects with high counts

Table 7 *Occupations and homes of the 10 patients with the lowest asbestos fibre counts in lung cancer series*

No.	Occupation	Home
0	Butcher	St. Helens
0	Grocer	Liverpool
0	Agricultural worker	Isle of Man
0	Butcher	Liverpool
0	Farmer	Lancashire
800	Farmer	North Wales
1000	Tailor	Liverpool
1400	Housewife, school canteen worker	St Helens
2000	Biscuit factory worker	Liverpool
2000	Housewife, laundry worker	Queensferry

Table 8 *Occupations of the 10 patients with the highest asbestos fibre counts in lung cancer series*

Number	Occupation
115 000	Ship's carpenter
107 000	Docker
136 000	Roadsweeper
151 000	Docker
146 000	Property repairer, plasterer
61 000	Ship repairyard labourer
88 000	Sewer excavator and building site labourer
61 000	Merchant service, atomic works construction
55 000	Decorator, painter
42 000	Docker

in the control series, and to those of patients in the mesothelioma series who had had considerable exposure to asbestos, six of them in docks or shipyards.

Discussion

DOSE RELATIONSHIP BETWEEN ASBESTOS EXPOSURE AND MESOTHELIOMA

Statements have often been made in news media and in the medical press suggesting that there is no dose relationship between asbestos exposure and mesothelioma, and this is probably a major source of alarm to the public, who have been told that nearly all adult lungs contain asbestos. As recently as 1976 a leading article in the *Lancet* stated that death from mesothelioma can follow quite casual and short-term exposure to crocidolite. In a search for the asbestos sources of 246 confirmed mesotheliomas which had been recorded in the British Mesothelioma Register in 1967 and 1968, Greenberg and Davies (1974) included 14 cases which they called non-occupational asbestos-induced mesotheliomas, where the actual asbestos exposure must in most cases have been slight and often very brief. Wagner (1972) stated that mesothelioma may follow brief, but not necessarily light, asbestos exposure, and said that there did not appear to be any clear pattern of dose response between asbestos exposure and mesothelioma. However, Newhouse (1973), from studies of asbestos factory workers, found that the mesothelioma rate increased with the severity and duration of asbestos exposure, and concluded that the formation of asbestos-induced mesothelioma is dose related.

The present study suggests a definite dose relationship between the numbers of asbestos fibres seen in the patients' lungs and the presence of asbestos-induced mesotheliomas. Ninety-five per cent of the patients with asbestos-induced mesotheliomas had over 50 000 asbestos fibres per gram of dried lung in the base of a lower lobe, whereas only 15% of the control series had as much asbestos (Fig. 4). It is true that in many cases the asbestos exposure of mesothelioma patients had been of short duration, sometimes only three months, but from the amount of asbestos fibres found in these patients' lungs the exposure must have been quite intense.

The risk of asbestos-induced mesothelioma to the general public, such as those in the control series, is probably confined to the top 15% referred to above, which include no women and only men working in jobs with a definite occupational hazard from inhaled asbestos.

SOURCE OF ASBESTOS IN ADULT URBAN LUNGS

In the control series, and in the lung cancer series, 57% of the patients had up to 10 000 asbestos fibres per gram of dried lung in the bases of their lower lobes. This amount of asbestos is probably harmless and may represent a background urban level created by the widespread use of asbestos in

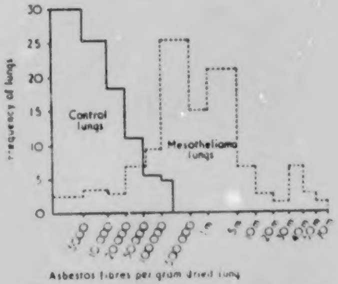

Fig. 4 *Comparison of asbestos fibre content of lungs from mesothelioma and normal control series*

the last half century. Higher levels of asbestos in lungs appears to be derived mainly from the occupations of the patients.

If urban asbestos pollution, severe enough to have caused mesothelioma, can be derived from living in the vicinity of asbestos factories, docks, and shipyards, as suggested by Newhouse and Thompson (1965) and Greenberg and Davies (1974), it would be expected that patients living near such areas would have high asbestos-fibre counts. Although Merseyside has contained no asbestos factories, which may be the heaviest source of atmospheric pollution, it contains many shipyards and docks and sack-repair factories. In the lung cancer and control series there were 73 patients who had lived the greater part of their lives in one district of Merseyside. Figure 5 is a map of the conurbation on which is indicated by stippling the sites of shipyards, docks, and sack-repair factories. The sites of patients' homes are indicated, those with less than 10 000 fibres per gram of lung being scored differently from those with higher counts; where a high count is fully explained by the patients' jobs this is also shown.

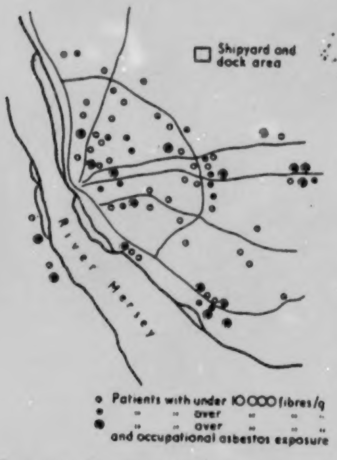
☐ Shipyard and dock area
River Mersey
○ Patients with under 10 000 fibres/g
● " " over " " "
● " " over " " "
and occupational asbestos exposure

Fig. 5 *Map of Merseyside showing sites of expected asbestos concentrations and the homes of patients with high and low asbestos-fibre counts.*

There is no concentration of high asbestos count cases in the vicinity of docks and shipyards, or to the north-east of them, allowing for the prevailing wind. Most high count cases near the suspect areas are fully explained by the jobs of the patients. In fact the map shows that shipyard workers and dockers tend to live near their jobs. The four high count patients inland of the city were dockers who, in later life, had moved to new housing estates.

HOME-ENVIRONMENT ASBESTOS-INDUCED MESOTHELIOMAS

Evidence supporting the existence of these tumours is provided by Newhouse and Thompson (1965) and Greenberg and Davies (1974), the former being a retrospective study of cases diagnosed in the London Hospital between 1917 and 1964, and the latter being an analysis of mesothelioma cases recorded by the Mesothelioma Panel in 1967 and 1968.

Bohlig and Hain (1973) have laid down criteria for acceptance of such tumours, including tumour histology, asbestos exposure history, and quantitative evidence of asbestos exposure from examined lung tissues. Few published cases meet these criteria, yet Bohlig and Hain do not emphasise the importance of obtaining detailed occupational histories from living patients.

This point is illustrated by many patients who were sack-repairers on Merseyside. The first two such cases were recorded by Owen in 1964, a further four cases were described by Whitwell and Rawcliffe in 1971, since when we have seen a further six patients, nearly all women. Since the beginning of the century, until the practice was changed quite recently, asbestos was imported into Liverpool in hessian sacks for further transport to Rochdale. Damaged sacks were repaired in sack-repair factories on Merseyside, where there were a dozen such factories. Although this hazard has been noted only on Merseyside, it is highly probable that asbestos was also shipped into London docks in similar containers for transfer to asbestos factories, and that damaged sacks were repaired locally in sack-repair factories, which were numerous in London. The patients, or more often their relatives, who were questioned by Newhouse and Thompson, were asked about employment in asbestos factories, not sack-repair factories, so many of the cases described as home-environment mesothelioma may, in fact, have been sack repairers.

Dependence upon relatives to provide industrial histories of deceased patients is often unreliable.

One of us (FW) has several times attended inquests on cases of mesothelioma where close relatives knew nothing about the relevant occupation of the deceased, who sometimes had lived near the docks. If the patients had not been interviewed about jobs while in hospital usually months before death, so that a true occupational history was known, the mesotheliomas might have been attributed to home-environment asbestos contamination from the docks.

Apart from the consideration of undisclosed occupational hazards, the possibility of a mesothelioma being a spontaneous tumour must be considered before it is accepted as being due to home-environment asbestos contamination, and this involves-assessment of the asbestos fibre content in the lungs, and the age of the patient. Many spontaneous mesotheliomas occur in young patients, even children, as can be seen from a study of the older literature. The actual age of the patient may often be less than the usual induction period of an asbestos-induced mesothelioma. In the present series only 7% of pleural mesotheliomas were thought to be spontaneous tumours, but this is much lower than their true incidence in the community, as spontaneous mesotheliomas are not always reported to the coroner. Probably only around 15% of mesotheliomas are spontaneous neoplasms at the present time on Merseyside where there are many sources of occupational asbestos exposure.

'SUB-ASBESTOSIS' ASBESTOS EXPOSURE AND LUNG CANCER

Lung cancer occurring with asbestosis has been known since 1935 (Lynch and Smith, 1935) but the incidence of this complication has increased greatly, so that nowadays over half the patients with asbestosis die from lung cancer (Buchanan, 1965). The tumour is usually found in parts of the lung most severely affected by asbestosis, and it is not clear whether the carcinoma is a reaction to the asbestos itself or to the fibrosis caused by it. It is generally held that asbestos exposure leads to lung cancer only when considerable asbestosis is present.

However, studies in America on large numbers of insulation workers, summarised by Selikoff *et al.* (1973) and Hammond and Selikoff (1973), suggest that the incidence of lung cancer in asbestos workers who do not have asbestosis is far higher than the incidence in an unexposed population, and that this high rate of lung cancer is dependent upon the workers being cigarette smokers. It is said that asbestos insulation workers with a history of regular cigarette smoking have eight times the risk of lung cancer compared with smokers not exposed to asbestos. In the various series studied there have usually been about three times the number of deaths ascribed to lung cancer compared with asbestosis. In spite of the large numbers of patients in these series there have been very few necropsy confirmations of the diagnosis, which has been made largely from radiographs and death certificates. The only study of the pathology of these cases is that of Kannerstein and Churg (1972) based upon 33 necropsy and 11 surgical specimens, many showing fibrosis and asbestos bodies as well as lung cancers, but the authors saw no correlation between the numbers of asbestos bodies and lung fibrosis in the areas examined.

If 'sub-asbestosis' asbestos exposure really increases the incidence of cigarette-induced lung cancer, as has been suggested, the lung tissues of an urban series of lung cancer patients might be expected to show higher concentrations of asbestos fibres than are present in a control series of lungs from a population of similar age and sex distribution. It was to answer this question that the present series of lungs from lung cancer patients was examined. The results show a very similar asbestos fibre content in the lungs of lung cancer patients and of controls. In both series 57% of patients had less than 10 000 fibres and there were fewer patients in the cancer series than in the control series with high counts.

This finding is the opposite of that reached by Warnock and Churg (1975), who compared the numbers of asbestos bodies in 30 cancer lungs and 100 control lungs, both series from an area of low asbestos pollution, and found significantly more asbestos bodies in the lung cancer series. They concluded that even extremely low levels of asbestos exposure may have a carcinogenic effect. However, their two series were ill-balanced, 77% of the cancer series but only 49% of the control series being men. The significant differences they reported are fully explained by the known higher incidence and levels of asbestos bodies in male lungs.

Our investigations into asbestos levels in the lungs of lung cancer patients in the general population provides some assurance that urban asbestos pollution does not contribute to the present high incidence of cigarette-induced lung cancer. However, it does not provide an answer to the important question whether asbestos workers can develop lung cancer from asbestos without first having asbestosis. Such an answer can be found only after extensive necropsy studies incorporating asbestos-fibre analysis.

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References

Ashcroft, T., and Heppleston, A. G. (1973). The optical and electron microscopic determination of pulmonary asbestos fibre concentration, and its relation to the human pathological reaction. *Journal of Clinical Pathology*, **26**, 224–234.

Bohlig, H., and Hain, E. (1973). Cancer in relation to environmental exposure. In *Biological Effects of Asbestos*, edited by P. Bogovski *et al.*, pp. 217–221. International Agency for Research on Cancer, Lyons.

Buchanan, W. D. (1965). Asbestosis and primary intrathoracic neoplasms. *Annals of the New York Academy of Science*, **132**, 507–518.

Gold, C. (1968). The quantitation of asbestos in tissue (abstract). *Journal of Clinical Pathology*, **21**, 537.

Greenberg, M., and Davies, T. A. L. (1974). Mesothelioma Register 1967–68. *British Journal of Industrial Medicine*, **31**, 91–104.

Hammond, E. C., and Selikoff, I. J. (1973). Relation of cigarette smoking to risk of death of asbestos-associated disease among insulation workers in the United States. In *Biological Effects of Asbestos*, edited by P. Bogovski *et al.*, pp. 312–317. International Agency for Research on Cancer, Lyons.

Kannerstein, M., and Churg, J. (1972). Pathology of carcinoma of the lung associated with asbestos exposure. *Cancer*, **30**, 14–21.

Lancet (1976). Asbestos in the air. Leading article. *Lancet*, **1**, 944–945.

Lynch, K. M., and Smith, W. A. (1935). Pulmonary asbestosis III. Carcinoma of the lung in asbesto-silicosis. *American Journal of Cancer*, **24**, 56–64.

Newhouse, M. L. (1973). Asbestos in the work place and the community. *Annals of Occupational Hygiene*, **16**, 97–107.

Newhouse, M. L., and Thompson, H. (1965). Mesothelioma of pleura and peritoneum following exposure to asbestos in the London area. *British Journal of Industrial Medicine*, **22**, 261–269.

Owen, W. G. (1964). Diffuse mesothelioma and exposure to asbestos dust in the Merseyside area. *British Medical Journal*, **2**, 214–218.

Selikoff, I. J., Hammond, E. C., and Seidman, H. (1973). Cancer risk of insulation workers in the United States. In *Biological Effects of Asbestos*, edited by P. Bogovski *et al.*, pp. 209–216. The International Agency for Research on Cancer, Lyons.

Thomson, J. G., Kaschula, R. O. C., and MacDonald, R. R. (1963). Asbestos as a modern urban hazard. *South African Medical Journal*, **37**, 77–81.

Timbrell, V. (1973). Discussion Summary. In *Biological Effects of Asbestos*, edited by P. Bogovski *et al.*, p. 131. The International Agency for Research on Cancer, Lyons.

Utidjian, M. D., Gross, P., and deTreville, R. T. P. (1968). Ferruginous bodies in human lungs. Prevalence at random autopsies. *Archives of Environmental Health*, **17**, 327–333.

Wagner, J. C. (1972). Current opinions on the asbestos cancer problem. *Annals of Occupational Hygiene*, **15**, 61–64.

Wagner, J. C., Sleggs, C. A., and Marchand, P. (1960). Diffuse pleural mesothelioma and asbestos exposure in the North Western Cape Province. *British Journal of Industrial Medicine*, **17**, 260–271.

Warnock, M. L., and Churg, A. M. (1975). Association of asbestos and bronchogenic carcinoma in a population with low asbestos exposure. *Cancer* (Philadelphia), **35**, 1236–1242.

Whitwell, F., and Rawcliffe, R. M. (1971). Diffuse malignant pleural mesothelioma and asbestos exposure. *Thorax*, **26**, 6–22.

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Mortality Experience Of Residents In The Neighborhood Of An Asbestos Plant

by
E. Cuyler Hammond, Sc.D.
Irving J. Selikoff, M.D. Lawrence Garfinkel, M.A.
and William J. Nicholson, Ph. D.

Conditions during 1949-1954 in an amosite asbestos factory located in Paterson, New Jersey and the subsequent mortality experience of the workers were described in a paper presented yesterday. This paper is concerned with the mortality experience of men who lived in the vicinity of that factory. The study was undertaken for the following reasons:

During the years in which the factory was in operation many of the workers were seen as private patients by one of us (I.J.S.) who had a special interest in tuberculosis and other lung diseases. Since their lung complaints seemed to be associated with their employment, he obtained information on their working environment. While no dust counts were made at that time, it was apparent by simple inspection that the men were heavily exposed to asbestos dust. Several attempts was made to relieve the situation by means of exhaust equipment. How effective this was within the plant is open to question; but the exhausts put dust into the outside air. Not only that, but in hot weather the windows were left open and asbestos dust blew around the neighborhood. So far as we know, no dust counts were made at that time. Therefore, we have no quantitative data on the degree to which the air in the neighborhood was actually contaminated. Many years later we collected samples of settled dust from the attics of houses in the neighborhood. Samples collected from houses near the factory still contained appreciable numbers of amosite asbestos fibers; those collected from houses located at a greater distance contained fewer fibers.

From this sketchy information, it is safe to assume that people living in the neighborhood were exposed to asbestos dust - obviously an extremely light exposure as compared with the exposure of men working in the plants. We became concerned about this at a much later date after the mortality experience of the factory workers became known. Question: does very light non-occupational exposure to amosite asbestos dust produce adverse effects to a measurable degree? (An extremely small effect would not be measurable by any means at hand. If there were absolutely zero effect, this fact could not be established).

Method And Material

The factory was located in a district known as Riverside which was largely residential during the period when the factory was in operation. The prevailing winds were generally such as to blow dust from the factory in the direction of most of the dwellings. From a map of the city as it was in 1942-1943 we ascertained the address of every Riverside dwelling located within one half a mile of the factory. Hereafter, we will refer to the area as the "target" area or simply as Riverside.

For comparison, we selected another Paterson neighborhood known as Totowa which is located several miles from Riverside. In the 1940's and 1950's the two districts were very similar in respect to the socio-economic status, race and national origin of the inhabitants as well as types of dwellings.

Fortunately, an excellent city directory of Paterson was published annually. It listed by name all adults (age 18 or older) living at each address and stated the occupation of the head of the household. Sex was not stated.

Our general plan was to trace - over a 35 year period or longer - residents of these two neighborhoods. We thought that this could be done for males but probably could not be done for females because of changes of name by marriage or divorce. Therefore, we confined our study to males.

City directories were available for each of the years 1942-1954 - the span of years during which the plant was in operation. A card was made for each apparently male resident for Riverside ("target area") and Totowa who was listed in at least two directories years 1942, 1943, 1944 and also listed in at least one of the directories for years 1945-1954. In case of doubt as to sex, the person was tentatively included as a subject. Later, in tracing the subjects, some were found to be female. Those were then eliminated from further consideration. We also eliminated from the study any residents in either area who worked in the asbestos plant.

Tracing

Tracing of the subjects was started in 1968; and those initially traced were re-traced periodically thereafter. As a first step, we searched for each subject in the then most recent issues of the Paterson city directory. If found, then we made contact with the subject (or a member of his family) by telephone, mail or home visit; verified sex, date of birth and determined whether the subject was still living. If the subject had died a copy of the death certificate was obtained. This yielded initial data on a considerable proportion of the subjects. We will call these "easy cases"; the remainder "difficult cases".

A list was made of the "difficult cases" and, thanks to the New Jersey Department of Health, every name of this list was checked against the list of all deaths occurring in New Jersey during the indicated interval of time. At the end of this process there still remained many subjects whose status was unknown.

How were these traced? Credit is due to our remarkable team of field workers. It would take many pages to describe all the methods they used.

After completion of their initial tracing, the subjects were retraced periodically. This is a continuing process. The last tracing was completed in 1977. For analysis of the data, it is necessary to select a cut-off date through which time a very large proportion of the subjects were successfully traced. The cut-off date for this report is December 31, 1976.

Table 1 shows the results of tracing through that date. The original list contained 7,653 names: 2,447 residents of Riverside (target area) and 5,206 residents of Totowa. By checking we found that 16 of the men had worked in the amosite asbestos factory (UNARCO); so these were excluded. Another 100 were excluded for the following reasons: female instead of male; accidental duplication of names; membership in insulation worker's union, etc. To this day we have never been able to trace 109 subjects (41 from Riverside and 68 from Totowa) so these must be excluded. After these exclusions the net total was 7,428 subjects.

Among employees of the asbestos plant, there was very little evidence of increased mortality until about 20 years after onset of exposure. This being so, we decided to confine the present study to the period starting on January 1, 1962 (roughly 20 years after the opening of the factory).

Of the 7,428 subjects mentioned above 1,743 had died before Jan. 1, 1962 and 5,685 were alive as of that date. Of these, 135 were excluded from analysis for the following reasons: 11 living but age unknown; 35 reported to have died, but death certificate not obtained; and 89 lost to follow-up.

The analysis which follows is based upon the final net total:5,550 men alive as of January 1, 1962 of whom 2,515 were dead and 3,035 were alive as of December 31, 1976.

Findings

Table 2 shows the dates of birth and age of the 5,550 subjects as of January 1, 1962. The distributions are not identical for Riverside and Totowa, but they are very close indeed. This fact greatly simplified the presentation of findings.

Ordinarily, in comparing the mortality experience of two groups of subjects it is necessary to take account of differences in age by some procedure such as age standardization. We carried out the procedure and found that age-standardization had virtually no effect upon the findings; this being due to the closeness of the age distributions of the Riverside and Totowa subjects. For this reason, we will present the finding in terms of the actual number of deaths and the percent of deaths of men alive at start of period for each of the two areas.

Mortality

Altogether, 780 (43.8%) of the Riverside subjects and 1,735 (46.0%) of the Totowa subjects died during the 15 year period January 1, 1962 - December 31, 1976. During this period cancer (all sites) accounted for the deaths of 163 (9.2%) Of Riverside subjects and 353 (9.4%) of Totowa subjects;

lung cancer 41 (2.3%) of Riverside and 98 (2.6%) of Totowa subjects. Thus in respect to total deaths, deaths from cancer (all sites combined) and lung cancer, mortality experience was a trifle worse in Totowa than in Riverside. Table 3 shows the corresponding figures for each of three 5-year time periods. In all three periods, total mortality was slightly higher in Totowa than in Riverside. In the first period cancer mortality (all sites) and lung cancer was higher in Riverside than in Totowa; in the second and third period, the reverse occurred.

Table 4 shows mortality experience for the entire 15 years. Both lung cancer and colon-rectum cancer mortality were a little worse in Totowa than in Riverside. The number of deaths from cancer of each of various other sites was so small that the differences in mortality (Riverside vs Totowa) are of no interest because of statistical instability. No deaths from peritoneal mesothelioma and just one death from pleural mesothelioma occurred during the 15 year period. This one death was that of a Riverside subject,an electrician, who died of pleural mesothelioma in 1966.

This is the only finding which gives even a hint that the slight asbestos exposure of Riverside subjects might perhaps have resulted in a fatality. What detracts from such a conclusion is the fact that the one mesthelioma occurred in the *first* of the three 5-year time periods rather than in the last of the three time periods. Based upon evidence from studies of people with occupational exposure to asbestos dust, we would have expected that the mesothelioma death would have occurred in the *last* rather than the first 5-year time period - but this is only speculation.

Paterson Neighborhood Study

TABLE 1. Tracing of Subjects

	TOTAL	Riverside	Totowa
tal - Original List of Names	7,653	2,447	5,206
leted from Study			
(a) Unarco Workers	16	4	12
(b) Females, Duplicates, etc.	100	27	73
ver Traced	109	41	68
ed before January 1, 1962-D.C. Rec'd	1,723	537	1,186
ported Dead before January 1, 1962-No D.C.	20	10	10
T NET Alive January 1, 1962	5,685	1,828	3,857
aced Alive December 31, 1976	3,046	1,003	2,043
ss:Traced Alive-No Date of Birth	11	4	7
NET Traced Alive	3,035	999	2,036
aced Dead January 1962 - December 1976	2,550	801	1,749
ss:Traced Dead-No D.C.	35	21	14
NET Traced Dead	2,515	780	1,735
t Traced	89	24	65
TOTAL INCLUDED IN ANALYSIS	5,550	1,779	3,771

Paterson Neighborhood Study

TABLE 2. Age Distribution of Subjects included in Analysis. Age 35+ on Jan. 1, 1962, excluding those not traced, Unarco workers, etc.

Year of Birth	Age in 1962	TOTAL		RIVERSIDE		TOTOWA	
		NO.	%	NO.	%	NO.	%
922-1926	35-39	201	3.6	76	4.3	125	3.3
917-1921	40-44	589	10.6	184	10.3	405	10.7
912-1916	45-49	803	14.4	279	15.7	524	13.9
907-1911	50-54	817	14.7	264	14.8	553	14.7
902-1906	55-59	784	14.1	231	13.0	553	14.7
897-1901	60-64	674	12.1	211	11.8	463	12.3
892-1896	65-69	654	11.8	208	11.7	446	11.8
887-1891	70-74	489	8.8	169	9.5	320	8.5
882-1886	75-79	294	5.3	90	5.1	204	5.4
877-1881	80-84	159	2.9	44	2.5	115	3.1
872-1876	85-89	69	1.3	19	1.1	50	1.3
<1871	90+	17	0.4	4	0.2	13	0.3
	TOTAL	5,550	100.0	1,779	100.0	3,771	100.0
	Mean Age				58.0		58.5

Paterson Neighborhood Study

Table 3

Number Of Deaths And % Dead Of Subjects

At Start of Period, Riverside And Totowa

Cause of Death	1962-1966		1967-1971		1972-1976		Total 1962-1976	
	Riverside	Totowa	Riverside	Totowa	Riverside	Totowa	Riverside	Totowa
All causes								
No.	279	611	259	609	242	515	780	1735
%	15.7	16.2	17.3	19.3	19.5	20.2	43.8	46.0
All cancer								
No.	62	119	52	134	49	100	163	353
%	3.5	3.2	3.5	4.2	3.9	3.9	9.2	9.4
Lung cancer								
No.	16	28	13	44	12	26	41	98
%	0.9	0.7	0.9	1.4	1.0	1.0	2.3	2.6
No. of Subjects At Start Of Period	1779	3771	1500	3160	1241	2551	1779	3771

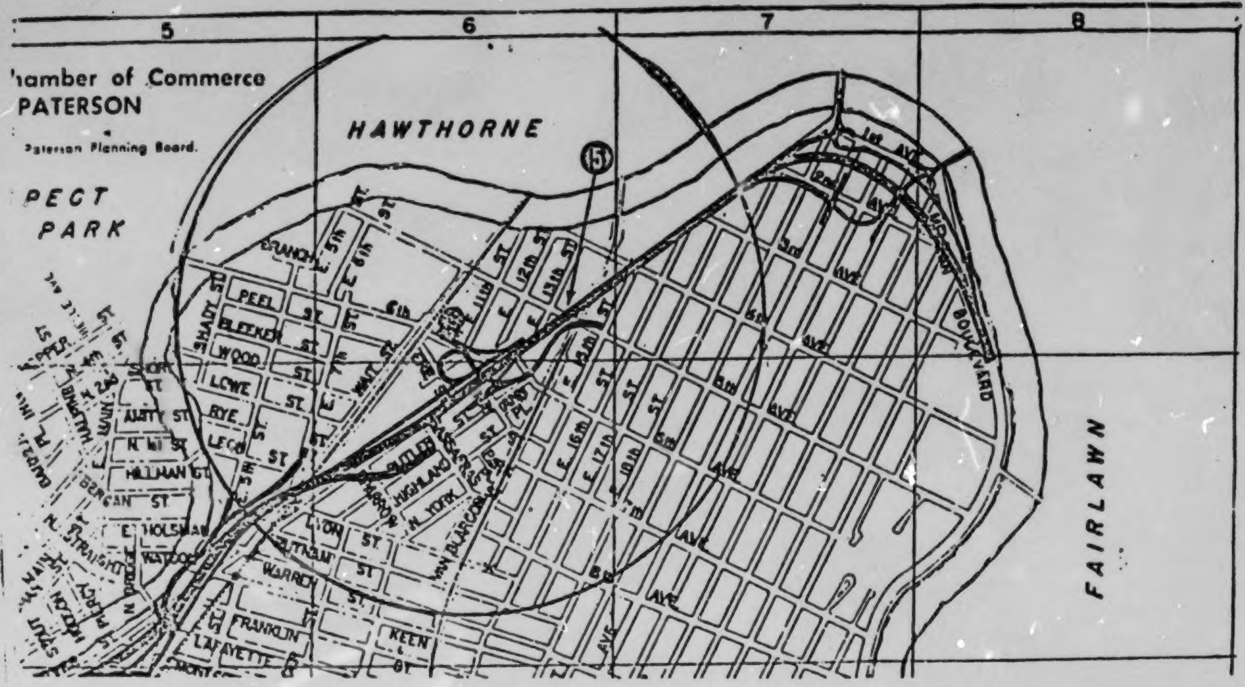
Paterson Neighborhood Study

Table 4

Number and Percent Deaths For

Cancer Sites, Riverside And Totowa

	Riverside		Totwa	
	No.	%	No.	%
Lung	41	2.31	98	2.59
Colon-Rectum	24	1.35	74	1.96
Prostate	17	0.96	37	0.98
Leukemia	11	0.62	15	0.39
Stomach	9	0.51	22	0.58
Pancreas	9	0.51	13	0.34
Kidney	5	0.28	7	0.19
Bladder	5	0.28	14	0.37
Lymphoma	5	0.28	9	0.24
Esophagus	4	0.22	12	0.32
Other Specified	23	1.29	41	1.09
Unspecified	10	0.56	11	0.29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OVERSIGHT HEARINGS ON ASBESTOS HEALTH HAZARDS TO SCHOOLCHILDREN

TUESDAY, JANUARY 16, 1979

House of Representatives,
Subcommittee on Elementary, Secondary,
and Vocational Education,
Committee on Education and Labor,
Washington, D.C.

The subcommittee met, pursuant to notice, at 9 a.m. in room 2175, Rayburn House Office Building, the Honorable Carl D. Perkins (chairman of the subcommittee) presiding.

Members present: Representatives Perkins, Weiss, Corrada, Miller, and Buchanan.

Staff present: Edith Baum, minority labor counsel; Toni Painter, secretary; and Nancy Kober, staff assistant.

Chairman Perkins. The Subcommittee on Elementary, Secondary, and Vocational Education is continuing hearings today on the possible hazards associated with the presence of asbestos in schools.

To my mind, this is a very serious issue which should concern everyone who has children in school or works in a school.

In several studies asbestos has been linked with an increased cancer death rate. While complete information on the presence of asbestos in schools nationwide is not available, testimony from our hearing last week indicated that as many as one out of six schools may contain asbestos.

This means that millions of our nation's schoolchildren could be exposed to a substance which, when released into the air, can pose a serious health threat.

The issue is complicated by uncertainty over whether any level of asbestos is safe for human exposure. In addition, removal or covering over of asbestos can be an expensive and even dangerous process if not carried out properly.

Along with several other committee members, I am considering introducing legislation to help districts deal with this problem. I hope that this hearing will shed some light on whether there is a need for Federal assistance and, if so, what form that assistance ought to take.

Our first witness this morning is the Honorable Andrew Maguire, Member of Congress, Seventh District, State of New Jersey.

Mr. Maguire, it is a great pleasure for me to welcome you before the committee. We appreciate the good work that you have always done and the results that you have obtained on many pieces of legislation concerning human welfare.

I am delighted to welcome you here. You go ahead, Mr. Maguire.

STATEMENT OF HON. ANDREW MAGUIRE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF NEW JERSEY

Mr. MAGUIRE. I wish to start, Mr. Chairman, by thanking you for those very kind remarks and for affording me the opportunity to testify this morning before the subcommittee.

From my involvement in the cancer issue as both a member of both the Health and Environment and the Oversight and Investigations Subcommittees, I am convinced that deteriorating asbestos ceilings in thousands of our nation's schools pose a serious, long-term threat of creating additional incidence of cancer among our vast, exposed student population.

The Environmental Protection Agency has not so far chosen to deal with this problem in the forthright manner which the evidence suggests is necessary. Because of that failure, I believe new legislation is necessary to reduce the danger that thousands of today's pupils 20 or 30 years from now will face. Some, of course, will face that danger much sooner.

I represent New Jersey, a State with the nation's highest cancer rate. I have become deeply involved in the cancer issue both within and outside of my committees.

I have worked on problems such as eliminating Tris from children's sleepware, trying to clean up the mess in Michigan caused by the inadvertant introduction of PBBs into the food chain, eliminating dangerous pesticides from the market, and retaining the protection of the Delaney clause, which prohibits the introduction of food of substances which cause cancer in animals.

I am convinced that the only way to lower our nation's cancer rate, which will take the lives of one in six Americans alive today, is to eliminate unnecessary exposures to cancer-causing substances.

One such substance is asbestos, a ubiquitous material in our industrial society. It has been widely used until recently as an insulation and fireproofing material in public and private buildings.

As we know from recent news stories, it was widely used in Navy shipyards during World War II, and those who worked there are subject to an unusually high probability of developing cancer.

It has also been used in spackling compounds, brake linings, and as road paving material. As a result, the background level in many areas is alarmingly high.

We know a great deal about high level asbestos exposures from the pioneering work of Dr. Irving Selikoff of Mount Sinai Hospital in New York City. We know considerably less about the effects of low level asbestos exposures such as are experienced by children in these schools with deteriorating ceilings.

We do know, however, that the majority of scientists believe that there is no known safe threshold for exposure to any carcinogen, that all unnecessary exposures to cancer-causing substances ought to be eliminated.

Two years ago, after intensive publicity about deteriorating ceilings in the schools of Howell Township, New Jersey, I became involved in trying to find a solution to this problem. Working with Dr. Selikoff and Dr. David Rall, a witness before this committee last week, I arranged for a small grant to determine whether there are effective methods of abating these hazards.

We have seen far too many examples of well-meaning but careless handling of asbestos where attempts to remove these ceilings have resulted in more, not less, asbestos being released into the air.

The study by the Mount Sinai team, which was headed by Dr. Bill Nicholson—and also a witness here last week—was to identify removal and sealing methods that would prevent asbestos from escaping into the outside air during the process and to insure the safety of the workers in real world situations.

The study relied upon visits to 48 of the 265 New Jersey schools where asbestos was found and tested sealing methods in two schools and removal procedures in a third.

It was found that safe and effective methods are now available for abating these hazards at reasonable cost, and I emphasize that point because initially people thought it was going to cost enormous amounts of money to treat an individual school or classroom.

We have found that that is not in fact the case. The study concluded that a 'prudent person approach' would indicate that, at least where feasible, excess asbestos exposures should be controlled.

The results of the Mount Sinai study were made available by the Department of Health, Education, and Welfare. But this clearly is not enough.

A recent National Cancer Institute survey estimated that at least 18 percent of future cancer cases will be due to exposures to asbestos. I do not believe that children in school seven hours a day, five days a week, should become part of this grim statistic. Clearly something must be done.

Unfortunately, I do not believe that individual localities or States will move aggressively to solve the problem. The removal and sealing procedures are affordable but without money in hand, and faced with what seem to be more immediate financial needs, most communities will likely put their money elsewhere unless there is a Federal assistance available to encourage abatement efforts.

For whatever reasons, EPA has not moved decisively and instead has adopted a voluntary approach of providing information but no money. But even if money were suddenly provided, that would not be enough.

There are too few laboratories equipped to do the electron microscopy to correctly identify the presence of asbestos in a given school. There are not enough trained contractors to seal or remove the asbestos without creating a greater risk by venting the deadly fiber into the atmosphere.

Clearly any reasonable and sufficient Federal program must include training and supervision components.

Increasingly, the Federal Government has initiated measures to control exposures to carcinogens and toxic substances.

The Department of Health, Education, and Welfare has initiated an ambitious program to alert the 8 to 11 million workers exposed to asbestos since World War II and to notify the nation's doctors of the increased risk these workers face due to these exposures, some of which were as brief as a month.

EPA has begun cataloging the production of the nation's chemicals and requiring premarket testing of new chemicals under the new Toxic Substances Control Act to assure that newly marketed chemicals are safe.

I believe a school asbestos abatement program aimed at decreasing the risk of cancer faced by the nation's schoolchildren is properly a Federal responsibility. Such a program is the job of the EPA, which has jurisdiction over such acts as Toxic Substances and Clean Air.

The school population is particularly vulnerable to exposures to cancer-causing agents such as asbestos. The cancer that may be caused by exposures early in life will appear at a much younger age than the exposures of our shipyard workers and thus cause much higher social and economic costs, even more than those that we already have with shipyard workers.

An effort targeted at reducing the cancer risk from exposures in the nation's schools would be a sound investment in preventive medicine, one which would in the long run reduce inflationary health costs to the nation.

I intend to offer legislation to provide the requisite training, supervision and funding for such a preventive program. We owe these children the opportunity for rich and full lives.

Thank you very much for the opportunity to appear here.

Chairman **Perkins**. Let me compliment you, Mr. Maguire, on your statement today.

To what extent has asbestos been removed in your congressional district, or in the State of New Jersey, if you know, from the schools where children are exposed?

Mr. **Maguire**. Mr. Chairman, we had a number of schools in my county where asbestos was present. Action has been taken in several of those schools, but not all of them. The pattern is similar throughout the State of New Jersey.

Action was taken in those instances where the situation was most obviously an immediate problem, and in particular in those situations which were the result of some special emphasis in the public media, which then resulted in parents becoming concerned and school boards feeling that they had a responsibility to respond to those concerns.

But in all too many instances—and certainly in cases where the asbestos material may not be obviously visible to the eye—flaking off and dropping from the ceilings—in those instances by and large action remains to be taken.

Now, of course there is, as I know you know from the testimony that has been given already, a continuum of types of hazard and degrees of hazard, depending on the type of material that was used, the type of backing in the wall or the ceiling to which the material has been attached.

There are various methods, some of which involve sealing the asbestos behind a hard surface, and others which involve removing the asbestos altogether.

But I would say that in most cases in New Jersey and across the country that action has not yet been taken because, first of all, people lack the information; second of all, even if they know, there generally is a problem, they haven't had an opportunity to test their own school buildings with reliable instruments; and thirdly, they have not had the wherewithal in the budget—and there are tight budgets in every locality, as you know, Mr. Chairman—to proceed.

Chairman **Perkins**. Well, let me ask you about that statement, the third reason you have given.

Is it because of a shortage of funds at the local school district level or at the State level that more of the asbestos has not been removed, inasmuch as it takes special technicians to do this job—is that what you are telling us?

Mr. **Maguire**. Yes, Mr. Chairman.

Chairman **Perkins**. The inadequacy of funds at the local level?

Mr. **Maguire**. Yes, Mr. Chairman. I think particularly where a major job needs to be undertaken, the funding can become a problem for the locality.

Chairman **Perkins**. We have got several witnesses, and we have got a caucus at 10:00. But, I would like to ask you one question.

Do you feel that the asbestos producing industry should be required to pay for at least part of the cost of removing asbestos from the schools where children are exposed?

Mr. **Maguire**. Yes, I do, Mr. Chairman. I think it is a classic example which we have seen in all too many instances where a substance or a product or a process was instituted without recognition of the consequences to individuals and to the society, and cost to the society, and that we will all share a responsibility for that, and must share in the solution of it.

Chairman **Perkins**. Mr. Miller?

Mr. **Miller**. Thank you, Mr. Chairman.

Mr. Maguire, I want to thank you for your remarks. I can't think of anybody in the Congress who has probably done more to draw attention to these concerns, I think, of millions of Americans around environmental cancer and possible causes and relationships between various substances in our society.

I am delighted that you are working on legislation because I am also attempting to do so. I would hope that at some point we could get together because the chairman of this committee, Mr. Perkins, has many times expressed his concern that this committee meet its mandates, certainly in relationship to the schools and the children.

I think that we have the chance to move legislation from this committee fairly quickly. So, I would hope that we would be able to benefit from your expertise and your long involvement in this problem.

Let me ask you a question in terms of how you feel about this as part of the solution.

We heard considerable testimony last week on two points: One, that there are not enough test facilities, as you have mentioned in your testimony, to really conduct a rapid nationwide program. We simply don't have the expertise or the facilities available.

But, we also heard considerable testimony that a significant percentage of the problem, and especially of the especially hazardous problem in terms of really asbestos in very bad condition, could be taken care of simply through a common sense approach.

Once you have made some determination that asbestos has been used, where it is falling down, where it has been vandalized, ripped apart, it has come out of its encased material, we should go ahead and start with the replacement or the sealing off of that material without waiting to do a series of tests or waiting for facilities to become available.

Do you have any thoughts on that in terms of the scientific community you have talked to?

Mr. MAGUIRE. Two comments. One, I would agree entirely that a common sense approach, the most scientific approach in this instance, would be to target those specific places where the problem is most severe.

It doesn't take an awful lot to figure that out, once people have a minimum amount of information at their disposal. Certainly in New Jersey we identified the schools which had the most serious problems, and in most instances those have been taken care of.

There are many others with sort of intermediate level problems that have not yet been taken care of partly because they were not as urgent and partly because we need, I think, a more thoroughgoing approach than we have had to date.

But clearly you are right that we can go after the ones which pose the most serious hazards.

Secondly, I think we should look very carefully at this question of just exactly what is required to get the kind of testing that we need.

I think, if my understanding is correct, that once you decide that you want to test a given school, that you can send an individual sample of material to a laboratory at some great distance, and have it tested, and get the answer.

Chairman PERKINS. Let me interrupt one point to say if the reporters are too crowded down there, you can use these chairs up here because all the members will not be here. You are perfectly welcome to use some of those seats over here on either side, if you prefer.

Go ahead.

Mr. MAGUIRE. It is probably also true that the few laboratories that are able to do this would be swamped if they had materials coming in all at once from literally thousands and thousands of schools across the country.

So, there ought to be some strategy developed, as you have suggested.

Mr. MILLER. One other point—since New Jersey has been actively engaged. The Chairman, I know—and I think we are going to hear from witnesses in Kentucky—some schools have already made an attempt to remedy the situation, and I think one of the things we would have to consider is whether or not schools, in terms of eligibility, this money could be made available to them retroactively.

I assume you have the same situation in New Jersey, where some schools are already undertaking, either because of the HEW alert or because of their own citizens, and they would also want to share in expensing out those costs.

Mr. **Maguire**. Sure.

Mr. **Miller**. You have no problem with that?

Mr. **Maguire**. Not only do I have no problem with it, it seems to me that it is important that people not be discriminated against, if you will, for having vigorously taken early action.

I think everyone ought to be able to share in whatever program is developed, whether they have already or plan in the future to take action action.

Chairman **Perkins**. Mr. Buchanan?

Mr. **Buchanan**. Thank you, Mr. Chairman.

I join in congratulating our colleague from New Jersey for his leadeship. I am sorry I did not hear all of your remarks, but I shall read the record.

Mr. **Maguire**. I thank the gentleman.

Mr. **Buchanan**. I get the feeling that a rather haphazard and indiscriminate use of asbestos and an unawareness of the potential dangers may still be a part of the problem. I get the feeling that there is not yet throughout the country an awareness, a sensitivity, to the possible dangers.

Would you say that is a correct evaluation? I know you use the words "thousands of students might be affected."

Mr. **Maguire**. Many thousands. I think you are right. In most parts of the country, where there has not been a celebrated case where parents become concerned and newspaper reporters and television cameras focus on the deteriorating ceilings and talk about clusters of cancer cases, I think people say, well, we are not using asbestos anymore, and yes, it is already in some of the buildings, but what can you do about it?

Mr. **Buchanan**. Thank you. I will look forward to the legislation you plan to introduce.

Chairman **Perkins**. Mr. Weiss?

Mr. **Weiss**. Thank you, Mr. Chairman.

I, too, want to express my appreciation to our distinguished colleague from New Jersey. I think this is an instance where your leadership role will save a great many lives.

Thank you.

Chairman **Perkins**. Mr. Corrada?

Mr. **Corrada**. I would just like to commend the gentleman from New Jersey for his interest in an area of great concern in the nation.

Mr. **Maguire**. Thank you.

Mr. Chairman, may I just say how appreciative I am that you and the committee and the subcommittee have undertaken this series of hearings and that you are going to take leadership on reporting legislation to the full Congress, so that we can get on with the job of protecting our children.

I am deeply grateful to you, as I know all Americans are.

Chairman **Perkins**. Let me compliment you, Mr. Maguire, for your leadership in this area. You have made a great contribution. We appreciate it. Thank you very much.

Our next witnesses are a panel from Kentucky.

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Dr. Graham, the Superintendent of Public Education; Mr. Barber, Deputy Superintendent of Public Instruction; Mr. Ray Brackett, Assistant Superintendent of Schools, Floyd County; and Mr. E. D. Grigsby, Jr., Floyd County Schools, Superintendent.

First we will hear from Dr. Graham, and then we will skip order a little and hear from Superintendent Grigsby, who has really got a problem in Floyd County, Kentucky.

We will hear from you first Dr. Graham. Then we will hear from you all. We have a caucus starting at 10:00 this morning, which it is necessary for all of us to attend. Regardless of how long the caucus takes, we will hear you.

Go ahead, Dr. Graham.

STATEMENT OF DR. JAMES B. GRAHAM, SUPERINTENDENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF KENTUCKY, FRANKFORT, KENTUCKY; E. D. GRIGSBY, JR., SUPERINTENDENT, FLOYD COUNTY SCHOOLS, PRESTONSBURG, KENTUCKY; RAY BRACKETT, ASSISTANT SUPERINTENDENT OF SCHOOLS, FLOYD COUNTY, PRESTONSBURG, KENTUCKY; RAYMOND H. BARBER, DEPUTY SUPERINTENDENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF KENTUCKY, FRANKFORT, KENTUCKY

STATEMENT OF DR. JAMES B. GRAHAM, SUPERINTENDENT OF PUBLIC INSTRUCTION, COMMONWEALTH OF KENTUCKY, FRANKFORT, KENTUCKY

Dr. **Graham**. Mr. Chairman, I have prepared a statement, of which I will just in cursory form perhaps summarize, so that we can——

Chairman **Perkins**. Go ahead. Without objection, all the prepared statements will be inserted in the record.

Dr. **Graham**. Mr. Chairman and members of the committee, I am James B. Graham, Superintendent of Public Instruction for the State of Kentucky.

I would like to take this opportunity to commend you, Mr. Chairman, and your committee for being so responsive to the problems created by the use of asbestos in school buildings in Kentucky.

You, along with school officials, are indeed interested in the health of the school children in the Commonwealth of Kentucky.

Your willingness to meet with us and to hear our concerns and problems is certainly indicative of your responsiveness to the needs of not only citizens in the Commonwealth of Kentucky, but throughout the nation.

With your permission and indulgence, I will make the following statement.

For the past two years much attention has been given to the problem of asbestos in school buildings in Kentucky. The Office of the Superintendent of Public Instruction was alerted in early 1977 to the hazards associated with the use of asbestos in school facilities.

In the months that followed, communications were received from the State of New Jersey and the United States Environmental Protection Agency concerning the seriousness of breathing air that

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has been exposed to asbestos fibers by school children and adults housed in certain buildings.

In March of 1977 the Kentucky Department of Education made a survey of local school districts to determine construction materials that were suspect of containing asbestos.

As of April 4, 1977, replies have been received from 124 of the 181 school districts. Sixty-five of those public school districts indicated the possibility of having asbestos materials in their school buildings. Sixty-eight nonpublic schools reported and six of those suspected asbestos materials. Forty-four vocational schools reported with two suspected of having asbestos materials.

As a result of the above mentioned survey, staff in the Kentucky Department of Education learned that we were confronted with a very technical problem.

We learned as a result of this experience and working cooperatively with the Kentucky Department of Labor medical consultant, that the determination of the level of asbestos materials used in a given building required a highly skilled technical staff with an electron microscope at their disposal.

You are aware of the research that has been done which indicates the serious medical problems that can develop as a result of minimal and short-term exposure in breathing asbestos materials. Further, you are aware that asbestos materials have been identified in schools in other States.

Because we recognize the seriousness of the problem, in the summer of 1977 the Kentucky Department of Education in cooperation with the Kentucky Department of Labor collected a number of samples of material thought to have asbestos from public schools throughout the State.

The following counties had samples that were suspected to contain asbestos: Barren, Butler, Christian, Daviess, Fayette, Floyd, Logan, Marshall, McCracken, Muhlenberg, and Union.

It should be pointed out that not all counties participated in the survey, including some with the largest population, such as Jefferson.

In addition to the school buildings in Kentucky, asbestos has been identified in other public buildings. This is not only a school problem. It is a problem in the hospitals and other public buildings in our State.

In October of 1978 a committee composed of members from various State agencies was formed to study the problem and make recommendation to the Governor and to the legislature regarding the extent of the problem and possible solutions.

Those agencies represented were Department of Housing, Building and Construction (Plans and Structure Changes); Department of Human Resources (Public Health); Fire Marshal's Office (Fire); Department of Education (Student Health); and Department for Natural Resources and Environmental Protection (Asbestos Exposure).

All the agencies involved agreed to cooperate and have cooperated in the effort to resolve the asbestos problem. This committee has met with parent groups from Floyd County discussing the problems relating to asbestos in the Floyd County School System.

Mr. Grigsby, the Superintendent, is here this morning. He has a very serious problem.

One of the major problems facing Floyd County and any other school district in the State that might have asbestos used in their buildings is the lack of funds to use in replacing asbestos. A contracting firm from New Jersey has indicated a willingness to instruct local contractors in the method for safe removal of the asbestos.

As a result of this committee's work, it was established that the first priority would be given to dealing with elementary and secondary schools in the State.

An attempt was made to identify the school buildings where asbestos would most likely be present. Attached to this report is a copy of the data received relative to the Kentucky school districts with a cost estimate for removal and replacement.

This is only a progress report to this point. We have not gone into it in detail. So, we only have a progress report.

Please keep in mind that the estimated cost and square footage is an estimate because the local school district personnel as well as the state staff do not have sufficient technical analysis of the suspected areas to fully validate the estimated data.

The University of Kentucky laboratory has been contacted about helping us analyze asbestos material. They have had no previous experience in this area and, therefore, would have to have training provided for their technicians in order to assist us in this area.

In December of 1978 Governor Julian M. Carroll appointed a Task Force on Asbestos in the Public Schools. The purposes of the task force are to evaluate the extent of the use of asbestos and the degree of health hazard posed by asbestos in public schools and evaluate the cost of remedying any identified asbestos problem in local school districts.

This task force is now at work, gathering data and material to present to the Governor. Mr. Butler, our Secretary of Arts and Education, is a member of that task force, representing education.

We have estimated in the problems identified approximately $12 per square foot to remove and replace. This is a broad estimate. It is not finalized. But, to take it down, you involve a lot of other things, such as lighting, et cetera.

May I express to you, Mr. Perkins, my appreciation for your interest and any relief that this group can give to us in the removal of asbestos and to enhance the health and welfare of our children would be seriously appreciated.

[The attachment to Dr. Graham's statement follows:]

DATA RELATIVE TO THE KENTUCKY SCHOOL DISTRICTS

COUNTY DISTRICTS	ESTIMATED SQUARE FEET
Barren	40,069
Bourbon	68,692
Bracken	20,000
Breathitt	15,370
Bullitt	8,739
Butler	16,924
Calloway	29,992
Carlisle	26,072
Carroll	14,656
Casey	40,000
Christian	82,300
Fayette	246,184
Fleming	88,757
Floyd	63,057
Franklin	4,000
Hancock	86,195
Henderson	22,272
Hopkins	44,800
Jackson	100
Laurel	9,400
Letcher	38,527
Lincoln	Unknown
Marion	9,275
McCreary	20,000
Oldham	38,776
Pendleton	11,264
Pike	111,240
Robertson	10,000
Rockcastle	21,600
Rowan	300
Russell	42,027
Todd	3,220
Trigg	107,814
Union	79,280
Washington	608
Woodford	8,595

INDEPENDENT DISTRICTS	
Ashland	2,214
Augusta	5,000
Bardstown	10,000
Caverna	2,000
Covington	120,651
Glasgow	576
Greenville	14,000
Ludlow	7,200
Middlesboro	25,100
Murray	16,662
Paducah	14,708
Paris	30,146

INDEPENDENT DISTRICTS (Continued)	ESTIMATED SQUARE FEET	
Raceland	15,303	
Russell	38,740	
West Point	Unknown	
Walton-Verona	8,000	
Williamstown	18,000	
Total Square Feet	1,622,405	x $12.00 per square foot for removal and replacement
Estimated Cost to Remove and Replace	$ 19,468,870	

DISTRICTS NOT REPORTING AS OF JANUARY 12, 1979

Allen
Ballard
Boyle
Clark
Clinton
Daviess
Edmonson
Elliott
Estill
Fulton
Gallatin
Harlan
Henry
Leslie
Lewis
Lyon
Marshall
Martin
McCracken
McLean
Metcalfe
Monroe
Montgomery
Muhlenberg
Nelson
Ohio
Owen
Owsley
Powell
Scott
Simpson
Spencer
Trimble
Warren
Wayne
Webster
Whitley

Chairman PERKINS. Thank you very much, Dr. Graham.

Without objection, we will postpone the questioning, because of the caucus, until all the witnesses have testified.

We will now hear from the Superintendent of Floyd County, where there is located the Consolidated High School in Prestonsburg, Kentucky that has caused concern.

We would like for you, Mr. Grigsby, to tell us about your problem. Tell us why the asbestos has not been removed. Tell us about the discussion that has taken place down there, and where you stand today.

Go ahead.

STATEMENT OF E. D. GRIGSBY, JR., SUPERINTENDENT, FLOYD COUNTY SCHOOLS, PRESTONSBURG, KENTUCKY

Mr. GRIGSBY. Thank you, Congressman Perkins.

I, too, am very grateful for this opportunity to appear before you and your subcommittee, to testify about our particular situation in Floyd County.

Chairman PERKINS. Talk just a little louder.

Mr. GRIGSBY. Can you hear me now?

Chairman PERKINS. Yes.

Mr. GRIGSBY. All right.

I wasn't close enough to the mike.

I want to thank you for this opportunity of appearing before your subcommittee, Congressman Perkins, to express to you our situation in Floyd County, particularly pertaining to one of our high schools.

Could I take just a minute and give you a little background of our school district. It is a large eastern Kentucky school district, in Congressman Perkins' district. It is a rural area in the coal fields of eastern Kentucky.

We are approximately the sixth largest school district in the State out of the 181. We have approximately 9,500 students, five high schools, 14 consolidated grade schools, K through 12, one four-room school, four two-room schools and, believe it or not, one one-room school, still.

I inherited a situation two and a half years ago in Floyd County, of which I am a native, and prepared myself for this position.

It wasn't until recently, until late this summer and early this fall, that it was brought to my attention that we had an asbestos problem in one of our high schools in Prestonsburg. The ceilings in the hallways and the bathrooms, and underneath the stairwells, contained a sprayed-on substance, which to my knowledge at that time I knew nothing of asbestos being in that building, since it was built in 1956.

A concerned citizens' group brought this to our attention. We ran the appropriate tests. We had to send the material to Kettering Laboratories, in Cincinnati, to get the final results.

Let me say this. In the past two and a half years since I have been Superintendent, we have been through two severe winters, the most severe in the history of this nation, not only eastern Kentucky; also, a severe flood in 1977, which practically wiped out one-third of our school district.

We had one high school, four elementary schools, one high school gymnasium, parts of two elementary schools, affecting 2,500 to 3,000 students. We had a problem of approximately $2 to $3 million damages to these structures.

Dr. Graham came up and inspected our school district. We were concerned with beginning school back in session for 1977–78, at very expensive costs to our school district. Because of that factor and inflation, and several other factors, we have been a deficit school district.

Now, Dr. Graham is the first to know what that means in our State. That means that we not only have a problem of asbestos in one of our school buildings, but we do not have the money to remove it.

Therefore, I have petitioned the Governor, Congressman Perkins, and our Senators, and others, if they could come up with some kind of money to help us remove the material. Also, I petitioned our local units of government.

Now, we cannot get permission to spend money we do not have, sir.

Another major problem—in our section of the county we have a lack of information and expertise. I could have well performed on that task force, after being through what we have been through.

I have learned more about the material and substances and manufacturers and contractors in New Jersey, and the situation in New Jersey, than I ever dreamed I would learn about as being county Superintendent of the eastern Kentucky school district.

There are contractors, we were told. I contacted EPA in Atlanta, Washington, the State of Kentucky, Frankfort, gathering information. That has been very slow coming in. That is something that is very pertinent to a lot of us in these areas in the United States—how to deal with it, having the knowledge, the expertise, contractors to do the job.

You have to do it according to specifications, I have learned, and so forth.

We were told by certain groups of people that there are only about 22 contracting firms in the whole United States that could perform this work. So, I have spent much of my time the past four or five months on this one particular problem.

In our area of the country, Congressman Perkins—and I am sure you know it better than anyone else, the lack of money, the expertise, the knowledge, contracting firms that do the job according to government standards, all of these we lack.

Chairman Perkins. Well, tell us some specifics. How much it is going to cost, what money you have available, the amount you don't have available, and the reason that you cannot get the removal job done down there.

Mr. Grigsby. We feel like we are working towards getting the job done, Congressman. We recently have contacted two firms in New Jersey—the Do-All Maintenance Company, and the Guardian Incorporated Company in New Jersey. They have sent representatives down there, just before Christmas, to look at the problem that we have.

We have a statute in the State of Kentucky that before we let things out on bid, we should have at least two bids. So, getting these people, the expertise into our area, has not been easy.

They estimate anywhere from $75,000 for either removal and replacement. The time is an unknown factor. Most of them tell you anywhere from 10 to 20 days, or so forth.

So, you see, it has been a problem to us all the time, in identifying the substance, gathering the information, having the knowledge.

By the way, thankfully, just before Christmas, the State did send out a survey for us to survey all our buildings, and we did, and thank God that is the only one we have in our school district that has asbestos in it.

Mr. Miller. Excuse me. Have you raised some money for this project already? I was informed about $70,000 or something has been raised through the Governor's office, and through the court, but you are going to lose that money because it is on the basis of an emergency and now the problem has dragged out so long.

Mr. Grigsby. No, sir, we got a commitment before Christmas from Governor Carroll of $35,000. The Fiscal Court committed $35,000 on the condition that we might do the job immediately.

What they meant by immediately was their interpretation. Like I said, we are in the process now of offering the contractor a bid. We cannot do anything other than follow State statutes in our State.

We have two bids now on the job. We can move only as fast as we are capable of moving as a body of government.

Mr. Miller. So, with that money from the county, will that remain available to you as far as you understand?

Mr. Grigsby. As far as I understand, it is unsure whether they are going to give us the money or not.

There was a little emotionalism that got involved in the situation. Some people tried to make a decision for the school board. The school board still had the authority to make the final decision, and to do all the work it had to do.

I think some people got too involved in our business.

Chairman **Perkins**. How has the community reacted to the asbestos and the removal of it? Have some of the parents held the children out of school, or anything of that nature?

Mr. **Grigsby**. Not that I know of. Not to my knowledge. In fact, the faculty and the student body of Prestonsburg High School has petitioned our school board to do the job, but not to take away their educational opportunities—go ahead and do it at the end of the term.

As you know, we missed much school there, particularly in the past two years. They felt like they should have the educational opportunity to finish this present term.

Besides, we have not completed all the work that is necessary to get the stuff out. Like I say, we lack the expertise, the knowledge and the money, and we are working towards those goals. We are only working as fast as we are capable of.

Chairman **Perkins**. When I was down there a few weeks ago, as I recall, someone mentioned to me that you perhaps could acquire all the funds with the exception of approximately $38,000.

I was over there. We were breaking ground for a housing project. I may be mistaken as to who approached me. But it is correct that you lack $38,000?

Mr. **Grigsby**. We still just have $35,000. We are trying to get the remainder of the money.

Chairman **Perkins**. Yes.

Mr. **Grigsby**. I understand the Governor is going ahead with his commitment of $35,000. But like I said, we are told by people who should know it is going to cost us $75,000 to $80,000 for the job.

Chairman **Perkins**. And you do not have that kind of money because of the other disasters that have struck?

Mr. **Grigsby**. No, sir, we do not have that kind of money at this time. We hope to in the future, but that is not helping our immediate problems.

Like I said, there may be other school districts in our area. Most of them I know, Congressman, in our district back home run a pretty tight budget. An emergency of this magnitude could cause them to slip into the red very easily.

It is not anything that we don't want to correct, sir. We want to correct it.

Chairman **Perkins**. Is some of this asbestos sagging from the walls, broken loose?

Mr. **Grigsby**. Well, some of it might be under the stairwell. After attention was called to the situation, we feel like, the school people feel like some of the kids took it lightly and might have reached up and grabbed a handful or two of it.

We posted signs telling them not to grab it. But if you recall your teenage days, sir, you might have grabbed some of it yourself, and I might have, too.

Chairman **Perkins**. Approximately how many square feet do you have in this particular school, and how many children go to this particular school?

Mr. **Grigsby**. Approximately 10,500 square feet, and about 800 to 850 students.

Chairman **Perkins**. 800 to 850 high school students?

Mr. **Grigsby**. Yes, sir.

Chairman **Perkins**. How many square feet?

Mr. **Grigsby**. 10,500, approximately.

Chairman **Perkins**. Mr. Miller?

Mr. **Miller**. I just wanted to say again—you are making every attempt to undertake to remedy the situation now. Would that be easier if legislation was moving through the Congress which would allow for retroactive payment?

Would the county feel more comfortable making emergency funds available, if they saw the Congress was prepared to come back and reimburse those bodies with help?

Mr. **Grigsby**. Yes, sir. Any form of funding, emergency funding and expertise and guidance in this area would certainly be appreciated by us, from a State level or from the Federal level.

Frankly, we didn't get a whole lot of help out of Frankfort from the other people. They didn't know a great deal to tell us or help us with. When we would ask them a lot of questions, they would refer us to another agency.

Also, in the money problem, we get referred to this group or that group, or this State agency, or this Federal agency. It has been something that we have not taken lightly. We have worked very diligently and hard on this problem.

Chairman **Perkins**. Mr. Buchanan?

Mr. **Buchanan**. Thank you, Mr. Chairman.

Dr. Graham, you indicated that not all counties have participated in the survey, including Jefferson County, the Louisville area. Is that underway at this point?

Dr. **Graham**. It is. We are having a systematic survey. This began only about two weeks ago. All of the districts were not in. That is why I alluded to it as a progress report.

Jefferson would contain approximately roughly 20 percent of the school building area. Now, I don't know whether this would involve—how much asbestos there would be. But, they have roughly about 18 to 20 percent of the children.

So, I am assuming that they would have the square footage of buildings likewise.

Mr. **Buchanan**. You gave an estimate of $19.5 million. Would that include a projection for Jefferson?

Dr. **Graham**. No. That just includes the counties listed here, and Jefferson is not included in that figure. Some others are not. We have 181 districts, and only about 124 have responded.

Of the remainder, Jefferson is included in that remainder, which would pose a serious money problem for all of us.

I really think that this problem is going to get more serious, more expensive in certain areas.

Mr. Grigsby has a serious problem. I don't want to minimize that. But, I don't want to minimize the State and the national problem likewise. I think that we need—of course, I thought we have needed money for school buildings and construction, which we never felt as though maybe we could afford it or something.

I think I would like to put in a plug for construction funds, at least to take care of this problem, really. It is a serious problem. Health has been one of our first cardinal principles, I guess, since 1918, along with the basics.

I am pleading for help at the national level to do something about this problem. There is a mood in Kentucky now. We have a special session. There is a tax cutting mood.

I don't know what they will cut, but this is a serious matter and will become more so when publicity and people become involved and concerned about their darlings. I cannot emphasize that too much.

Mr. Buchanan. Thank you.

Chairman Perkins. Mr. Weiss?

Mr. Weiss. Thank you, Mr. Chairman.

I think this has been very important testimony. Together with the earlier testimony we heard last week, it dramatically underscores the severity of the problem and how widespread it is, that it is not limited to any particular section of the country, that all of the school districts apparently have the same severe problem of identifying the material and finding the money to deal with the problem.

I think it underscores, as I have stated, Mr. Chairman, the fact that the responsibility of dealing with the problem lies in the Congress.

Thank you.

Mr. Miller. Mr. Chairman?

Chairman Perkins. Mr. Miller?

Mr. Miller. If I might just pose a somewhat hypothetical question. When I look at the figures that you are talking about in terms of replacement costs, in your case we look at the anticipated figures of New York City, some other large cities—I think I can quickly get up close to have a billion dollars, with very little trouble.

That is just the replacement. Forget the technical assistance, the research and so forth.

What would be your response to a long-term loan from the Federal Government in terms of no interest or low interest, but probably no interest loan, in this situation?

Given the tightness, certainly what we anticipated to be the tightness of the President's budget, to talk in with what could clearly escalate into a billion dollar program with very little effort, and if the health hazard is as we believe it is, and as I assume some of your constituents believe it is, what would be the response in terms of a long-term loan?

Dr. Graham. Mr. Miller, that is an approach, certainly. I don't want to say anything that would minimize the approach, and certainly not look a gift horse in the mouth, as the old saying goes.

But, I think the loan would be one approach to it. Whether in the long purview of the situation it is the complete answer, I don't know. But, it is a beginning. It is an approach. For that reason, I think it is certainly worth discussion.

Mr. **Miller**. Okay. I don't especially want to put you on the record pro or con, because I think we are going to have to exhaust some discussions with local school people such as yourself and with the chairman and with the agencies.

But, I can see down the road that can become a very real problem in terms of just the sheer numbers of this problem.

Thank you.

Dr. **Graham**. I concur completely with the magnitude of the problem as you have expressed it. I would certainly hope that your committee gives this a quick long-term solution because it is going to become one of the heated problems of schools and education, as I see it, in the next year or two.

I know Congressman Perkins, whom we have great confidence in in Kentucky, and the members of this committee, have always been responsive to our school needs. For that I want to congratulate him, and you personally. I know you will do what is right.

I understand the fiscal constraints. But, if you analyze Kentucky, Pete has just scratched the surface. We have floods. We have had weather which they are having, as you know, in Chicago. We have had a series of debacles that have been horrendous when you look at them.

I am sure Kentucky is not an exception. This problem is prevalent in the United States. We are going to have to resolve it. We simply don't have the money in Kentucky.

I don't believe you can depend on the generosity and good will of people when they are paying a tax for their schools to maybe go the second mile. Some of them will, but this is not the answer.

Chairman **Perkins**. Mr. Buchanan?

Mr. **Buchanan**. Thank you, Mr. Chairman.

You are certainly to be commended, Doctor, in trying to get a handle on the whole problem through your survey activities. It seems to me we must do that nationwide.

I do want to ask you if you have considered any alternatives to removal and replacement in all cases. Obviously the most complete protection is removal and replacement.

Dr. **Graham**. Right. I think when you deal with this problem, if you leave any chance factor in what we are doing here, you are still not going to satisfy the great element of the public because there is going to be suspicion and a little reluctance to say that you have done the job.

Let me again re-emphasize what I have said. These are tentative figures. Please accept them as that because we got an estimate of somewhere between $10 and $12 and $9 and $13 a square foot for complete removal, now, and replacement.

This is doing the job in a complete and adequate fashion. This survey is tentative. It is complete. It is accurate, as far as we went. But, we do not have all the districts. Jefferson, being the largest, is not included.

We are talking in upwards of somewhere in the neighborhood I would guess of $25 million to $30 million for the State. This is a pretty good chunk of money.

Chairman **Perkins**. Let me make an observation. I am reading a letter I just received from the Office of the Secretary, HEW, in response to a letter that I sent down on January 10, 1979.

I detect it is going to be really difficult to get the Administration to go along with us on this program. In fact, they say they do not have the authority and so forth and so on.

We can give them the authority without difficulty, but getting the money out of this Administration at the present time is a horse of a different color, even for the most beneficial welfare programs. It is going to be very difficult.

We doubt we would have the votes to pass over a veto, but we are going to do our darndest to get some Federal assistance. We may be successful and we may not. I would like to ask you one final question, because I think the various school systems of the country are going to have to set some priorities within their school systems.

Have you attempted to rank the schools that have been found to contain asbestos according to how serious the asbestos exposure is?

Dr. **Graham**. Congressman, I didn't understand your real question. I just don't hear as well as you hear.

Chairman **Perkins**. Have you ranked the schools which have been found to contain asbestos according to how serious the asbestos exposure happens to be?

Dr. **Graham**. Congressman, I would have to say at this point that I couldn't answer your question with any definiteness.

I think what we have been told to this point is that the problem potentially is there. We do not have any hard data where we have come in and analyzed, and we don't have any data that this material is carcenogenic; and of the districts in Kentucky, I would have to say Floyd County at the moment has a very serious public relations support problem because of it.

Chairman **Perkins**. Mr. Grigsby, how many public meetings of the PTA and other groups have already taken place in the City of Prestonsburg concerning the school situation?

Mr. **Grigsby**. We probably have had four or five meetings with the citizen groups at board meetings, I would say, over the past four or five months.

Chairman **Perkins**. And during that period of time some parents have refused to send their children to school, haven't they?

Mr. **Grigsby**. Sir, you brought that up a while ago, and to my knowledge there has only been one person, and she put it in the paper, that she was withdrawing her child from the school; and the principal tells me that is the only one he knows of.

In fact, the student body wants to go to school there at Prestonsburg. Many of them want to get summer jobs, want to go on to college. Many of them felt like they had been cheated of their educational opportunity the past two or three winters; and it is just a matter of opinion.

Like I say, some got emotionally involved and felt like they should make decisions for administration of the school board; and there is only one person I know, and that had to do with a different decision.

Chairman **Perkins**. Several people talked to me about that on the street.

Mr. **Grigsby**. Yes, sir; I understand that. We have cooperated and worked with this group very closely. I spent a whole month going to Frankfort and writing you and other people.

Chairman **Perkins**. I think you are a good school superintendent. I in no way intended to be critical; I was just trying to get the facts as best I could.

Mr. **Grigsby**. Yes, sir; I understand that.

Dr. **Graham**. Congressman, as a final note in response to your question—I do think I understand what you were getting at now—we have not presented any serious ranking of districts according to the seriousness of the problem in the school buildings per district. We have not done this yet.

I would say, generally speaking, that we can do this on a fiscal basis. We could take and rank them, the seriousness of the problem, budgetwise, of how they could meet it looking at their budget, but the problem itself, I would say, is universal.

And we built a lot of buildings, as you know, during WPA days that had asbestos. Many of our older buildings have asbestos in them.

Now as to the seriousness of the problem, I think we could get some ranking per square footage in the school districts which would probably relate to what you are talking about. Maybe this district would have 10 percent of asbestos fiber ceiling and another might have 50. Do you see what I am saying?

Chairman **Perkins**. Yes.

Dr. **Graham**. We haven't done this, and we probably will do this later.

Chairman **Perkins**. That, coupled with the asbestos that has broken loose from the walls and is sagging down further, would have a tendency to mean more exposure?

Dr. **Graham**. Right.

Chairman **Perkins**. We will recess this hearing. I hate to. No witness will be stood up here today. I can't tell you how long this caucus will last. I don't want anyone to dispossess me of my chairmanship this morning. I'd better go off myself.

In addition to that, we are going to convene at noon, but if the caucus can break up at 11:30, I will come back here and hear you until noon. But if it does not, as soon as the House adjourns this afternoon I will take time to hear all the witnesses, even if it is six o'clock or ten o'clock; it will make no difference. I hate to cause the witnesses all this inconvenience, but since you are here let's remain here and you will all be heard.

That's all I can tell you. Thank you.

Dr. **Graham**. Thank you.

Mr. **Grigsby**. Thank you, sir.

[Brief recess.]

Chairman **Perkins**. All right, Mr. Grigsby, you have your assistant there?

Mr. **Grigsby**. Yes, I would like for you to address to him some questions.

Chairman **Perkins**. Just go right ahead.

STATEMENT OF RAY BRACKETT, ASSISTANT SUPERINTENDENT OF SCHOOLS, FLOYD COUNTY, PRESTONSBURG, KENTUCKY

Mr. **Brackett**. Mr. Perkins, I have very little to add to the testimony that has been given at this point in time this morning, other than some of the hard experiences that a school administrator has to go through in living and dealing with the PR problem of suspected or known asbestos in a school.

With some figures that I have, I would like to help plead a case for the State of Kentucky, and from information I have to point out the seriousness of the problem for some of our neighboring States.

I had one figure quoted from the Lexington Herald Leader in January, 1979, that pointed out that only at this date 6330 schools of 90,000 in the nation had been actually inspected, and at that time 973 were identified as built with asbestos. Indiana, our close neighbor across the river, was reported to have 260 out of 542 schools that had been inspected to have a known problem of asbestos.

Chairman **Perkins**. Let me say at that point that the Secretary of HEW has called this to the attention of all the governors of the country, and many of the schools have now been inspected around the country. I hope we have not been that derelict, but the studies aren't complete by any means; they are still taking place.

Go ahead. Excuse me.

Mr. **Brackett**. Some school districts may be faced with the alternate choice of using encapsulation methods whereby a spray-on type of epoxy paint or some other material might solve the problem immediately; but I think we have to deal with that problem and realize that that is only touching the tip of the iceberg because the problem is still there.

The fibers of asbestos may not be airborne, but then if that school district or that public entity makes a decision at a later date to renovate that buidling, to do extensive plumbing, or wiring, or demolition of that building, they are right back to the starting point, of having to search out this technical expertise to do the removal job.

I think our points have been made. I reiterate those this morning: The lack of test facilities—we have already borne that expense; it has cost us somewhere in the neighborhood of $200 just to get the analysis done at this point in time. The lack of qualified contractors—we have been told—I don't know how accurate the figure is—that there are 22 of these nationally. The time element that has been involved—I think from a public relations standpoint all parents want the substance removed at a given time, which is convenient to them, and this is at a time when school is not in session, in the summer months or during the spring break, or during the Christmas holidays; and if there are only 22 firms throughout the nation—and the one firm that we have dealt with has only seven employees; that would be brought in. They cannot be made available to all people at all times at their given time.

Of course, the fiscal, financial, restraints or constraints that are placed on a district, the lack of availability of funding—I think those would add to the remarks that have been made here this morning.

Chairman Perkins. Mr. Grigsby, do you have any further comments or do you have anyone with you that wants to make any further comments about your situation down in Prestonsburg?

Mr. Grigsby. Maybe one comment. I would just like to put a plea in for other school districts, particularly in your area, eastern Kentucky, Congressman. If these problems, which I am sure some of them have, like Dr. Graham stated, I would like to see some agency—on a State level, possibly—established so as to help them with their problems, since Kentucky is so isolated because of many of these problems, like contracting firms, and expertise and so forth; and I am positive in my assessment—if I am not right, you correct me—Knott County, Perry County, if they have asbestos in their school buildings, they will not have a budget to come up with emergency funds ranging from $70,000 to $200,000.

I would just like to state that if we had five more buildings in our district with asbestos in them, I don't know what we would do. Frankly, I don't. That would be five times $70,000, $350,000, approximately.

I would just like to put a plea in for other school districts in the State of Kentucky. They are not that rich. Most of them would be similar to ours.

Chairman Perkins. Any questions?

Mr. Buchanan. No questions, Mr. Chairman. I hope we can find a way to be helpful.

Chairman Perkins. Let me thank all of you for coming here this morning. You have been very beneficial to the committee. I don't know what this committee will do. I know what Mr. Buchanan will do, and several of the Democrats will do, and others; but with the attitude of the Office of Management and Budget it is going to make it more difficult for us up here. However, we are going to do the very best we can until several of us work out a bill in the next few days. We do not intend to delay by any means; we intend to move forward.

Mr. Grigsby. Thank you very much, Congressman and your committee members. We appreciate the invitation.

Chairman Perkins. Our next witnesses are a panel from New Jersey: Mr. Vincent B. Calabrese, Assistant Commissioner for Finance and Regulatory Services, Department of Education; and Dr. Irving Peterson, Director of Facility Planning, Department of Education.

Come around, gentlemen.

We have Michigan, too. Dr. Leonard L. Jensen, Director of Systematic Studies, Wayne County Intermediate School District, Michigan; and Mr. Lee Jager, Bureau Chief, Bureau of Environmental and Occupational Health, Michigan Department of Public Health.

Is Mr. Calabrese here? (No response.)

Is Dr. Irving Peterson here? (No response.) Apparently not.

We will take the next panel. Is Dr. Leonard Jensen here? Mr. Jager? (No response.)

Mr. Steinhilber, I understand you have to leave right away. If you will come around, we will hear from you right now. We all know you, but please identify yourself for the record.

Without objection, your prepared statements will be inserted in the record. We are delighted you are here and welcome you.

STATEMENT OF AUGUST W. STEINHILBER, ASSOCIATE EXECUTIVE DIRECTOR, FEDERAL RELATIONS; ACCOMPANIED BY MICHAEL A. RESNICK, ASSISTANT EXECUTIVE DIRECTOR FOR LEGISLATION DAN LEVIN; AND MARCIA WEISS, NATIONAL SCHOOL BOARDS ASSOCIATION

Mr. **Steinhilber**. Thank you very much, Mr. Chairman. It is a delight to be before your committee again.

I have brought with me, particularly for questions and answers, Michael Resnick, Assistant Executive Director of the National School Boards Association; Dan Levin, who wrote the article in the American School Board Journal about asbestos that has been published around the nation; and Marcia Weiss, who will be handling this particular issue for our Legislative Office.

Mr. Chairman, I am going to make my statement as brief as I can for the sake of time.

I think there are certain aspects of this which obviously you have been aware of but which I would like to underscore.

I think the very first aspect that I would like to point out is the tremendous cost that the removal of this dangerous material is going to incur at the local school districts. You have already heard testimony that in New York City alone it is going to cost roughly $8 per square foot for removal. We know that in one school district in Massachusets it cost $275,000 for one school, and they didn't remove it. What they ended up doing was putting in, in effect, an artificial ceiling, and somewhere along the line that too may have to be removed, so this $275,000 expenditure is going to have to take place one more time.

We also know that when we are talking nationwide, we are talking about between one and five percent of the school districts in the United States which were built between the late forties, all the way up to 1973—we know between one and five percent of those buildings have asbestos—and it wasn't until asbestos was declared a dangerous substance that they have ceased to use it; and, strangely enough, this means some of the buildings which were most recently built are going to be the ones that are going to be the most problem.

With the declining enrollment, which currently the tendency is, if you are going to close the buildings, you close the old ones which were built in the 1920s or 1930s; and yet we are going to have to look at refurbishing the brand new buildings, so to speak, the ones that were built, many of them, within the last ten years.

I think the other question that I would like to point out is one that has been called many things, but I think the best way to call it is "fiscal responsibility at the local level" and that relates to what has happened in the last election, in the last couple of elections, at the local level.

For school districts to go out and raise bonds at this point in time is not, I would say, the most enticing thought at the local level. Bond issues are very difficult to pass and in most places it would be illegal under State law to try to put it under noncapital operations—in other words, under the regular maintenance and operation of the school district—so you can't use it out of operating funds. You are going to have to go to the bond issue, and once you do you have to go to the public at large.

At the same time we are going to be going to the public at large for the question of asbestos, we are caught with all of the other problems relating to bond issues, the most costly of which, of course, is the removal of architectural barriers for handicapped children.

So school districts are going to be caught in a very tremendous fiscal restraint situation. Timing is very important, and that is one of the reasons we are delighted that this committee is looking at it and looking for it to help school districts in a very trying time.

The question periodically comes: How should the funds be distributed? Quite frankly, we are opting for the grants operation, although we think that reimbursement may be possible in some areas. For some school districts, grants are the most expedient method of obtaining funds for hazard abatement. For other districts, reimbursement is best.

To put those two in perspective, there are some school districts that are not going to be able to put up the up-front capital to take the risk, if you will, for reimbursement. Other school districts will be able to make that quantum leap. So, therefore, it is a combination that we are suggesting. Obviously, we would prefer the grant proposal, but we are also aware of the fiscal restraints that are being placed upon this Congress and the budget of the Administration in the ensuing years.

Our testimony goes into a little bit of detail on how to develop priority needs. I am not going to describe them in any great detail, only to say that we do say that there should be some cost accountability and that Congress should establish a prevailing fee concept which would allow reimbursement on the basis of the local market cost for the job. Therefore, school districts would have something to judge against, so that if there are exorbitant fees involved, that they have some incentive, if you will, sir, to look at what kind of contracts come in, to make sure that this has not been developed in such a way that would fly in the face of good accountability.

There is always that kind of option available if you are just plain handing the bill over to a second party; so, therefore, we are suggesting some ideas on accountability.

We have finessed the question in our testimony: Should the industry itself contribute to the removal? It is a very delightful idea; however, we just feel that at this moment in time we don't have the answers to the questions.

We would like to have industry pick up part of the cost, but, nevertheless, what has happened to industry over the period of time? Are the same individuals making asbestos now, or have they gone out of business? Where are the businesses located?

So, while we would look for some assistance along this line, it probably is not very realistic to look at it in terms of being able to find somebody really accountable for it.

The questions of who should administer the program is indeed a perplexing one. We would contend, as it is in our testimony, that you might look to a specialized task force within the Federal

Government that can look for the expertise over several agencies to help in the administration.

The age-old questions comes on, How should the money be distributed? In that realm, we would contend that the money should go directly toward local school districts, the reason being that in the United States right now most construction programs are administered strictly at the local level, albeit I realize if you are talking about Maryland, it is a State fund for construction in Maryland. In Virginia, for example, the State department does review the architectural plans. But this is by and large the minority of States. Indeed, in most States in the United States they are currently trying to put the data together, and we would have it for this committee if you would permit us to submit it later.

We would say in most States in the United States that figure probably will exceed 35 States, subject to the review we are doing. There is no reviewing factor at the State level with respect to school construction of any size, shape or form.

That, Mr. Chairman, is the substance of our testimony. I realize the details are before you.

[The complete statement of Mr. Steinhilber follows:]

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Testimony on behalf of the

National School Boards Association

on

Asbestos in Schools

before the

Subcommittee on Elementary, Secondary, and Vocational Education

of the
House Committee on Education and Labor
2175 Rayburn House Office Building

Presented by

August W. Steinhilber
Associate Executive Director, Federal Relations
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January 16, 1979

Mr. Steinhilber is accompanied by:

Michael A. Resnick
Assistant Executive Director
for Legislation
National School Boards Association

...SERVING AMERICAN EDUCATION THROUGH SCHOOL BOARD LEADERSHIP

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Introduction

My name is August W. Steinhilber and I am Associate Executive Director for Federal Relations of the National School Boards Association. I am pleased to have this opportunity to testify before the Subcommittee on Elementary, Secondary, and Vocational Education on the subject of asbestos in schools. The National School Boards Association is the only major education organization representing school board members -- who are in some areas called school committee members or school trustees. Throughout the nation, approximately 90,000 of these individuals are Association members. These people, in turn, are responsible for the education of more than ninety-five percent of the nation's public school children.

Currently marking its thirty-ninth year of service, NSBA is a federation of state school boards associations, with direct local school board affiliates, constituted to strengthen local lay control of education and to work for the improvement of education. Most of these school board members are elected public officials. Accordingly, they are politically accountable to their constituents for both education policy and fiscal management. As lay unsalaried individuals, school board members are in a rather unique position of being able to judge legislative programs purely from the standpoint of public education, without consideration to their personal professional interest. My statement today is on behalf of Margaret S. Buvinger, President, and Thomas A. Shannon, Executive Director, of the National School Boards Association.

School board members across the country are becoming aware of the potential health hazard of sprayed asbestos materials used for insulation and fireproofing in school buildings. It is clear from the evidence being gathered, and from facts that have been presented before this Committee, that school districts may have to spend thousands, and sometimes millions, of dollars to remove or seal contaminated areas. It is important that we proceed quickly but rationally.

NSBA is grateful to be included at the initial stages of consideration of a legislative response to this problem. Because the asbestos hazard in schools has been pointed out only recently, and because school districts are just becoming aware of the situation, we know little about the scope of the problem. States are only beginning to survey their schools and, in many, the sampling is haphazard. Federal assistance is needed. The purpose of our testimony today is to pose some questions, and to discuss in a preliminary way, what help the federal government might offer to local school districts.

I. How Should the Asbestos Hazard Be Approached?

A. Information

The EPA has undertaken a program to notify school districts about the potential hazards of asbestos. In March, every school district in the nation should receive a guidance document prepared by the EPA and its consultant, asbestos expert Dr. Robert N. Sawyer. This manual will enable local school personnel to identify the problem where it exists and to respond responsibly to the problem.

With the guidance document in hand, the problem for local school boards no longer is "Do we have asbestos in our schools?" or "How bad is the asbestos in our schools?" or even "What should we do about the asbestos in our schools?" It is, quite simply, "How do we pay for a solution to the problem?"

B. Funding

Anthony Smith, Executive Director of the Division of School Buildings for the New York City Public Schools, testified before this Committee that the cost of containing asbestos is $8 a square foot in New York City. Newton North High School in Massachusetts spent $275,000 to combat its problem and it didn't even remove the asbestos from the building. The District of Columbia has begun the process of removing, isolating or sealing 30,000-40,000 square feet of asbestos in six schools. At $8 a square foot, the cost would be in the range of $300,000. Nationwide, the costs will result in enormous unexpected expenditures for school districts which already may be suffering from forced cutbacks in their budgets and from taxpayer reluctance to increased education spending.

A large expense like this may have to come out of (a) program budgets or already-committed funds; (b) be raised through taxes; or (c) through bond issues. Each of these methods may cause political or legal problems. First, if capital improvements are involved - as in the case of encapsulation of an asbestos-laden ceiling, the bond mechanism probably will have to be used. As members of this Committee know all too well, taxpayers sternly are resisting efforts to borrow money for construction. But even where the referendum is successful, the process of authorizing a ballot, receiving clearance by bond attorneys, allowing the legally requisite time for an election and finally receiving all bids and beginning construction is tremendously time-consuming. Moreover, each time a school board approaches the community with a bond plan, it cuts into the board's ability to raise revenue in the future.

In some states, school districts are legally restricted in the use of operating funds and the methods of raising revenues. Further, even if school districts could use operating revenue, they would not be inclined to do so because large capital outlays could devastate their current operating budgets. Also, a sound approach to public finance dictates that large, long-term investments should not be paid for solely by taxpayers who happen to reside in the community at the time -- all in one year.

Timing also is part of the financing problem. While parents who do not fully understand this complex, incendiary problem have pressed school districts to remove the asbestos quickly, it should be realized that summer or extended vacation periods are the most realistic times to do the work. When school is in session, there are problems sealing off the work area for a removal operation; major renovation and construction projects are difficult to undertake when students and personnel are in the building. In the context of bond referendums, the bidding process, and passing tax levies, the timing issue becomes especially critical.

II. How Can the Federal Government Help?

While we may be considering one percent to five percent of schools in the country, as EPA estimates, (there are 100,000 schools in the U.S.), there may be several thousand more schools affected than that figure indicates. There does not seem to be evidence that the problem is concentrated in particular regions of the country, but it is likely that suburban schools are especially involved, since many of them were built from 1946 to 1973. Given the critical situation in many school districts, the phenomenal expense which may be incurred, and the widespread application of asbestos, NSBA favors direct assistance to aid local school districts in asbestos hazard abatement.

EPA has the capability to assist in solving health hazards such as the asbestos problem. Furthermore, it seems important that there be national direction to a program of information dissemination and hazard abatement; EPA has made several important first steps, such as its plans for mailing the guidance document to every school district in the nation, and its efforts should be augmented. Further, it is clear that the expertise and commitment are found only at the federal level. The states have been slow to move and tentative in their action in this area. Their reaction to the problem thus far has been uneven and, in some instances, counterproductive. It simply is not necessary to create another bureaucratic layer which would divert funds from hazard abatement into a state administration that likely is ill-prepared to handle the problem. The local school districts, once they review the EPA materials, will be able to make all the necessary decisions without help from a state agency.

A. What Agency Should Direct the Program?

Would a hazard abatement program be best done by the EPA? It has the authority, and it has regional offices already operating through which information and technical assistance can be funneled, and through which oversight can be done.

Would a separate entity be better? It was suggested in earlier testimony before this Committee that there be set up an "Asbestos Working Group," or "Task Force" with experts and managers from several agencies directing the project. It may be useful to establish a working group under EPA or HEW authority. It could go out of business when the school project is done, or it could tackle the problem of asbestos in other public buildings.

B. How Should the Program Be Structured?

Should federal funding of asbestos removal be done through grants or through reimbursements? For some school districts, grants are the most expedient method of obtaining funds for hazard abatement; for other districts, a program of reimbursement is best. It is important to note that competitive bidding, which many school districts are required to use in contracting construction or renovation, eliminates the possibility that school districts will not efficiently spend the federal funds. Even where school districts choose direct contract negotiations, inducements to hold down costs can be built into any legislation. We will refer to this point later in the testimony.

A grant program easily can be regulated through establishment of criteria for acceptance. Second, school districts can know ahead of time how much money they will have to work with. On the other hand, one drawback to a grants program is that the application process may take far too long to allow some school districts to act quickly to remove the hazardous asbestos. However, a grant program may be the best approach for districts that may have unusually high concentrations of the most hazardous types of asbestos, and are unable to generate their own funds for removal.

Likewise, a system of reimbursement also can be attractive. For example, school districts with available funds can get started right away on asbestos removal, isolation and containment, with the anticipation of recovering all or part of its investment in the near future.

Further, reimbursement also encourages school districts to keep down costs of projects - particularly if only a partial reimbursement is allowed.

Moreover, reimbursement may give maximum flexibility to local school districts in determining how to solve their problems. (However, total flexibility without some guidance could result in a mishandling of hazard abatement projects.)

From a practical standpoint, reimbursement will benefit districts that have available operating funds while penalizing districts that may be unable to dip into their budgets for cash on the barrelhead. Poorer districts with severe asbestos problems simply will not be able to take part in a reimbursement program. For this reason, NSBA supports a program that includes both grants and reimbursements to local school districts.

III. How Will Reimbursement Work?

Inasmuch as a reimbursement program may be a new concept to some Committee members, we would like to outline some considerations that need further exploration.

A. Priority Needs

In developing a reimbursement program, a major consideration is how to treat school districts when there is an insufficient federal appropriation for 100% coverage. At first glance, it may appear attractive either to limit assistance to the most severe situations or to rank school districts on some criteria of need. NSBA believes both approaches should be rejected.

With respect to making reimbursement on a "most serious need" basis, it should be noted that this discourages a coordinated approach for asbestos removal in local school districts. For example, some individual schools may have asbestos problems with varying degrees of damage and flaking, and in different (and possibly inaccessible places) which call for several approaches. In those instances, it may make more sense to do all the repairs in one school at once, rather than in phases. (Of course, in some schools though, a phased plan is more appropriate.).

With respect to ranking local school districts on the basis of financial need, schools will not commit themselves to such a program because they will not be aware of the priorities beforehand. Therefore, for these districts, there could be a special grant program, with a quick application process.

B. Cost Accountability

As in the Medicare program, Congress could establish a "prevailing fee" concept which would allow for reimbursement on the basis of local market costs for doing the job. School districts could apply for reimbursement and receive it directly from the federal government.

IV. Should There Be Protections Given to School Districts Which Apply For Grants or Reimbursement?

A. A district's application for a grant in itself should not imply that removal, isolation, or sealing must take place.

B. There should be no involvement of enforcement agencies which would make removal mandatory at this stage or threaten a cutoff of other federal aid.

V. What Should The Grant/Reimbursement Program Consist of Within the Agency?

A. There should be a program which would train inspectors and other personnel to deal with asbestos problems.

B. There should be a program for dissemination of information through regions.

C. There should be continuing investigation of effects of asbestos, and extent of cancer and other diseases (EPA; NIH; NIOSH; OSHA?).

D. There should be an on-going program of study of the effects of asbestos, and continuing investigation of methods of removal, and alternative ways short of removal, of controlling asbestos.

E. There should also be close oversight of the asbestos removal program by this Committee. The agency should report at six-month intervals on the progress of the program and any relevant new developments in research, findings, techniques of removal, changes in costs, or other factors.

VI. Should the Asbestos Industry Contribute to the Removal?

NSBA would prefer not to make any judgment about industry payment for removal at this time. However, Congress should seriously consider whether manufacturers have the responsibility to contribute to removal of the asbestos.

In conclusion, NSBA is grateful for the opportunity to contribute to the Committee's conideration of legislation which will help school districts meet the cost of asbestos hazard abatement. We look forward to working with the Committee to draft legislation which assists school districts to remove this serious health hazard in our schools.

Chairman **Perkins**. Let me ask you one question: In your capacity of representing the school boards throughout the country, what, in your opinion, would be an equitable formula for participation so far as State and local governments are concerned?

Mr. **Steinhilber**. One of the problems that we have is, we are trying to find where these particular buildings are. We know the period of time in which they were built. We also found out that in many school districts they don't know that they have them. If they do have them, they have to go through a very detailed process of finding whether asbestos has been used in construction. So, therefore, the incidence of problems are going to be scattered throughout the United States; it is not going to be located in one geographical area; it is not going to be located in one particular State; and it is hard for us to count the number of classrooms or the number of buildings involved. It is not like Title I, where you can count the number of disadvantaged children and come up with a formula, or with 94-142, where you are going to count the number of handicapped children and multiply it by the formula.

In this instance we don't have that kind of data—I don't think anyone has that kind of data—so, therefore, we are not looking for an allocation of formula, that money should be available at the Federal level on an individual grant-by-grant application. I realize that it is somewhat different than we have ever testified before, but we haven't come up with an answer, to come up with a formula.

Chairman **Perkins**. You feel that the local school district should be required to participate financially where a bad condition exists?

Mr. **Steinhilber**. They would participate directly with the agency which has responsibility for it, I would say, kind of direct participation similar as it is, like, let's say, Public Law 815, where applications come directly to the Federal Government.

Chairman **Perkins**. Any questions, Mr. Buchanan? It is very good testimony.

Mr. **Buchanan**. Thank you, Mr. Chairman.

In your written statement, in phrasing the EPA action and pointing up the need for Federal action, you point up that EPA is planning to send a guidance document to every school district in the nation in March. You say in that connection that: "the States have been slow to move and tentative in this, their action in this area. Their reaction to the problem thus far has been uneven and, in some instances, counterproductive."

One of the problems, it would seem to me, is that we don't know how big the problem is, and I am not sure there is enough concern and sensitivity throughout the country for enough to have been done to get a handle on where the problem is and how great it is. Do you feel this to be part of the problem at this point?

Mr. **Steinhilber**. I think it is, but I am going to ask the two people who have been basically working on this far greater than I to lend their advice to that. Mr. Resnick?

Mr. **Resnick**. Thank you.

One of the things that needs to be taken into consideration is not just identifying where the school buildings are, but also the logistics of how the problem is going to be solved. For example, in Mr. Steinhilber's testimony he pointed to the fact that school systems may have to go through the bond issue route in order to remove the problem. For most school districts, that would require authorizing a bond issue to take place, then having a bond council review the matter, having it put up for an election in a timely manner, and that, of coruse, costs money as well, and going to competitive bid, which many States require of school districts, and finally to begin construction.

So there is a tremendous time factor that exists along with the identification of the problem, and when that is taken together with the fact that this type of hazard should be removed probably during the summer period, or during other vacation periods, the timing of bond issues, together with the ideal period of time, makes it extremely difficult; and, of course, that can be by-passed through a Federal grant program.

Even in States where you can take it out of operating revenue, even there you still have the problems of competitive bidding and meeting a time schedule that can phase into the summer period or into the other vacation periods.

On the question of a formula, if you will, we realize the question of reimbursement has been discussed, and reimbursement, as Mr. Steinhilber pointed out, tends to help those school districts that have the money up front, that have the money within their cash flow, or in their operating budgets; whereas, those school districts that don't, that are most in need, won't.

We realize that it may be that the Federal appropriations may not be sufficient to take care of all needs. We think it would be a mistake, however, to require school districts to take care of their most needy problems first, because then it prohibits them from taking a comprehensive approach to removing asbestos.

For example, you can look in one school building and find varying degrees of the problem. To require just hitting the most, or addressing the most hazardous problem first may, in the long run, prove to be a lot more costly; so that what we would prefer is perhaps to have within a Federal program a special category for school districts that meet some definition of need, so that they can move comprehensively and quickly to remove the problem in their particular area.

Mr. LEVIN. I think, Mr. Buchanan, you hit on a very salient point before, in regard to the States' handling of the problem. They simply, really haven't addressed it properly. Some have addressed it well and others just have created problems for local school districts. When the EPA finally does mail out this condensed guidance document to local school districts, a local school district will be able to solve the problem on its own.

The guidance document will go a long way in helping them toward that end. To create another bureaucratic level at the State level, I think, would not be in the best interest of the program.

Mr. BUCHANAN. Mr. Steinhilber, it seems to me that this is an area where entities you represent may have to provide substantial leadership if we are going to get the problem solved; and I wonder if you think they ought to put up some of the money as well?

Mr. **Steinhilber**. The answer is, we already are; and the answer is, obviously, yes, in reality school districts are going to have to come up with money to do it, because if one starts taking a look at the costs involved and starts taking a look at where the current appropriations for education are, in reality will the Appropriations Committee even be willing to take that huge amount of funds, perhaps in the billions and billions of dollars? That is going to be very difficult.

Mr. **Buchanan**. Thank you.

Chairman **Perkins**. Thank you very much. You have been very helpful.

Mr. **Steinhilber**. Thank you, Mr. Chairman.

Chairman **Perkins**. Is Mr. Calabrese here, Assistant Commissioner for Finance and Regulatory Services, Department of Education, State of New Jersey?

Dr. Irving Peterson? (No response.) They are not back yet.

All right, we will go over to another panel. Dr. Leonard L. Jensen—is he here?—Come on around and take your seat—Director of Systematic Studies, Wayne County Intermediate School District, Michigan. Is Mr. Lee Jager here—Bureau Chief, Bureau of Environmental and Occupational Health, Michigan Department of Public Health?

Go ahead, Dr. Jensen. Identify yourself for the record and go ahead with your statement.

Without objection, your written statements will be inserted in the record.

STATEMENTS OF DR. LEONARD L. JENSEN, DIRECTOR OF SYSTEMATIC STUDIES, WAYNE COUNTY INTERMEDIATE SCHOOL DISTRICT, MICHIGAN; AND LEE JAGER, BUREAU CHIEF, BUREAU OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH, MICHIGAN DEPARTMENT OF PUBLIC HEALTH

STATEMENT OF DR. LEONARD L. JENSEN, DIRECTOR OF SYSTEMATIC STUDIES, WAYNE COUNTY INTERMEDIATE SCHOOL DISTRICT, MICHIGAN

Dr. **Jensen**. Mr. Chairman and members of the committee, I am Leonard Jensen, Director of Systematic Studies for the Wayne County Intermediate School District, Wayne County, Michigan. I am a member of the American Industrial Hygiene Association, the Michigan Industrial Hygiene Society and a Diplomate of the American Academy of Industrial Hygiene, having been certified in the Comprehensive Practice of Industrial Hygiene by the American Board of Industrial Hygiene. I have testified before the Occuaptional Safety and Health Administration and the National Advisory Committee on Occupational Safety and Health on a number of occasions.

The extensive scientific literature has established beyond reasonable doubt that asbestos is a highly toxic material causing asbestosis lung cancer and mesothelioma in animals and man exposed to airborne asbestos dust. The lowest concentration of asbestos dust that will cause these conditions is not known; however, the concentration that has resulted in physiological damage to exposed personnel in many cases must have been extremely small.

The current threshold limit value used by OSHA is a compromise based upon the lowest feasible limit possible at this time in industrial situations. These limits were never intended for use involving exposure of the general public. Thus, exposure to asbestos dust, a known carcinogen, should be avoided where possible.

It should be kept in mind that a toxic material adequately controlled does not constitute a hazard. Toxicity is an index of the inherent ability of a material to cause an adverse reaction; whereas, hazard is the probability that the material under a condition of use will result in an adverse reaction.

Asbestos, because of its chemical inertness, heat resistance, tensile strength and flexibility, has been used as a building material, especially as an insulator against heat and noise. During the years of the school building boom that followed World War II, asbestos was widely used for acoustical treatment of ceilings, for heat insulation and for fire-proofing. A major architectural firm that designed nuemrous school buildings in the Midwest estimated that about 70 percent of the school buildings designed by this firm during 1953 to 1963 used sprayed asbestos as the acoustical treatment for the ceilings in corridors.

The procedure was stopped about 1963 because the sprayed material was subject to damage when students contacted the surface with broom handles and similar devices. Asbestos in some cases was sprayed on the steel structures for fire control. Other uses include asbestos ceiling tile, floor tile and insulation around steampipes.

Asbestos is also used for brake linings and clutch facings that may be encountered during maintenance of buses and industrial arts automotive classes.

Since the extent of the hazard of the exposure to asbestos in school buildings is not known, it is recommended that a proper survey of each building where personnel are present be conducted, the survey team to include a member of the architectural firm that designed the building or made changes to the building, a competent industrial hygienist, members of the school staff familiar with the building and any others deemed necessary.

Such a group would be able to determine the extent of the hazard posed in each building.

Based upon the results of the survey, the survey group would be able to make recommendations as to the type of action that may be necessary to control exposure to asbestos dust where that exposure is occurring or may occur in the future.

Chairman PERKINS. Mr. Jager, you go ahead.

STATEMENT OF LEE E. JAGER, BUREAU CHIEF, BUREAU OF ENVIRONMENTAL AND OCCUPATIONAL HEALTH, MICHIGAN DEPARTMENT OF PUBLIC HEALTH

Mr. JAGER. Thank you, Mr. Chairman, members of the committee.

My name is Lee Jager. I am the Chief of the Bureau of Environmental and Occupational Health with the Michigan Department of Public Health. I welcome the opportunity to appear before your subcommittee today to discuss studies that have been and are now being done in Michigan to determine the public health significance of asbestos materials in public buildings, especially in schools.

I have presented the committee with two written documents today. One is the text that I am reading from now; the other is a preliminary report on the studies that were completed sometime ago on the asbestos in schools.

Shortly after receiving reports of asbestos in New Jersey schools in 1976 and '77, the State Public Health Department of Michigan, in cooperation with several local health departments, conducted a pilot study of asbestos exposure in Michigan schools. After an initial screening of many schools—and we have lost track of the exact number of these schools, but it is something over 1,000, and more than 200 schools were actually visited during that study—of the 200 schools visited, 64 were found to contain material suspected to be asbestos material in 18 schools.

Airborne sampling was conducted in 13 of those 18 schools and airborne fibers were found in only one. The concentration of fibers determined in that school was 0.04 fibers per cubic centimeter of air. There is no established limit to compare this number to, the generally accepted concept being there should be zero fibers present. OSHA has set a limit for the workplace which is two fibers per c.c.—time weighted eight-hour average.

Our Health Department agrees totally that that is not an appropriate number to use for determining a safe level of asbestos in such a place as a school.

OSHA has also set a ceiling limit—never to be exceeded—of 10 fibers per c.c.

Sufficient potential for exposure was found in our pilot study to cause us to greatly expand our study efforts which we have recently done.

On pages 3 and 4 of the report I have given you today there is a copy of a letter signed by the State Health Director and State Superintendent of Public Instruction which effectively broadened the study to include all public and parochial schools in Michigan.

Some work has already been done under this expanded study. For example, public schools for the City of Kalamazoo—a city with a population of approximately 85,000—have been evaluated. Asbestos material used as pipe insulation has been found in one of six schools and instructions have been sent to the County Health Department on further sampling and protective measures that should be taken. See the letter to the County Health Department which is attached. However, it is too early to draw conclusions on the public health significance of our findings.

Based on our findings to date, we are hopeful that our study will determine that very few, if any, students have been exposed to excessive airborne asbestos fibers in their school environment. It is already obvious, however, that the potential health risk is significant and many school buildings should have corrective measures taken in the near future to remove the potential hazard.

At present we feel that removal of the material should be done only in extreme situations and only in close coordination with public health and fire protection officials. We believe there are reasonable means readily available to stabilize, isolate or otherwise secure most situations. In fact, we have not yet encountered in Michigan a situation extreme enough to recommend removal of the asbestos construction material. If the asbestos is secured so as to prevent fibers from becoming airborne, we believe the health hazard will be adequately controlled.

I wish to thank you again for the opportunity to be at this hearing. I would be pleased to respond to any questions.

[The attachments to Mr. Jager's statement follows:]

WILLIAM G. MILLIKEN, Governor
MAURICE S. REIZEN, M.D., Director

STATE OF MICHIGAN
DEPARTMENT OF PUBLIC HEALTH
3500 N. LOGAN, P.O. BOX 30035, LANSING, MICHIGAN 48909

January 12, 1979

Mr. Patrick Krause
Division of Environmental Health
Kalamazoo County Health Department
418 W. Kalamazoo Avenue
Kalamazoo, Michigan 49007

Dear Mr. Krause:

On January 8, 1979, six material samples were submitted by you to this laboratory for asbestos analysis.

Upon examination by X-Ray Diffraction, the following results were determined:

Location of Sample	Percent Asbestos as Chrysotile/Amosite
Parchment Northwood Elementary, ceiling tile near gym (hallway).	No asbestos detected.
Parchment North Elementary, Room 115 ceiling tile.	No asbestos detected.
Parchment Middle Schools, ceiling tile, old part of building.	No asbestos detected.
Parchment North Elementary, wrapping on steam pipes.	33.6%
Parchment Middle School, ceiling tile, new part across from Room 103.	No asbestos detected.
Parchment High School bathroom.	No asbestos detected.

MICHIGAN
THE GREAT LAKE STATE

"Equal Health Opportunity for All"

We recommend that the Parchment North Elementary steam pipe wrapping be carefully inspected to see if there are reasons to believe that this material may be sluffing off or may become airborne and thus result in the exposure of building occupants to asbestos fibers. Actual exposure conditions in the area can be tested for the presence of asbestos fibers. We are prepared to assist in this testing by providing trained personnel and sampling equipment to perform the sampling. We would also process the samples in this laboratory and determine if fibers are present.

If you find that there is a significant potential for the materials to be dislodged and to become airborne, we strongly recommend that the surface be covered to prevent the material from being damaged or abraded in such a manner as to produce asbestos fibers in the air. Consideration must be given to the maintenance of proper fire ratings to comply with State Fire Marshall codes and regulations. We recommend that before any surface treatment or cover material is installed that the changes be reviewed and discussed with the Ciry or State Fire Marshall to be sure it meets with their approval.

At this time we do not necessarily recommend removal of the material if the material can be enclosed or covered up in such a manner as to eliminate the exposure hazard. Any attempt to remove the material will require complete isolation of the area and the complete protection of workers to assure that they are not exposed to asbestos fibers in the removal and reconstruction process.

Very truly yours,

BUREAU OF ENVIRONMENTAL
AND OCCUPATIONAL HEALTH

Alvin L Vander Kolk

Alvin L. Vander Kolk, Chief
Division of Technical
Supporting Services

AVK:pp

MICHIGAN DEPARTMENT OF PUBLIC HEALTH
PILOT STUDY

ASBESTOS IN MICHIGAN SCHOOLS

January 15, 1979

In January, 1977, following reports of asbestos exposure in New Jersey schools, the Bureau of Environmental and Occupational Health in cooperation with several local health departments initiated a pilot study of asbestos exposure in schools. The study was coordinated through the (then) Engineering Advisory Committee, now the Environmental Health Advisory Committee, and was conducted in three phases:

1. Environmental health personnel in the participating local health departments subjected schools in their jurisdiction to three tests to determine if there was likelihood of asbestos exposure:

    a. The presence of sprayed-on fibrous insulating material known to contain asbestos or suspected to contain asbestos.

    b. The insulating material was open to occupied rooms or was in the form of panels which were uncovered or unpainted and were subject to flaking and/or physical damage; or,

    c. The insulating material was in a return air plenum or false ceiling space used as a return air path.

    Where there was a question of a school fitting these conditions the school was visited to establish its status.

2. Where these conditions were known to exist samples of the fibrous insulation were obtained by local health department personnel and analyzed by the Department's Technical Supporting Services laboratory in Lansing.

3. Where asbestos was confirmed by laboratory analysis staff members from the Division of Occupational Health evaluated each school, obtaining air samples as necessary to evaluate potential exposure to airborne asbestos fibres.

The pilot study of record covers the period from December 15, 1976, when the Bureau had first begun to receive inquiries, to December 31, 1978. On or about January 1, 1979 school authorities in Michigan received a joint letter from Maurice S. Reizen, M.D., Director of the Michigan Department of Public Health and Dr. John W. Porter, Superintendent of Public Instruction, which effectively broadened the study to include all public and parochial schools in Michigan. This letter is attached.

A preliminary report of the pilot study was prepared in October, 1978 to assess findings up to that time. The purpose of this present report is to write the final chapter on the pilot study. This report differs from the preliminary report in the following respects:

- Recognition is given to the local health departments in Macomb and Monroe counties, who, rather than conduct a pilot study, contacted all schools within their jurisdictions. A copy of the contact letter and the follow-up letter used by the Macomb County Health Department are attached.
- The data includes material samples taken by personnel in the Division of Occupational Health in addition to the samples obtained by the local health departments.
- This report also includes the data gathered in the period October-December 31, 1978.

SUMMARY

In all, more than 200 schools were visited and 64 schools met the test for suspected asbestos exposure. Overall results are summarized in Table I, II, and III. Table IV is a listing of the schools which were investigated and Table V is a listing of other establishments where asbestos investigations were conducted in response to individual requests. Table VI presents data on other asbestos samples submitted to the Technical Supporting Services Laboratory in earlier years.

Approximately 30% of the schools surveyed in the pilot study met the test for suspected asbestos exposure. Of these, 18 were found to have asbestos on the premises; these amounted to no more than 9% of the total number of schools investigated. Of the schools where asbestos materials were encountered, 34 air samples were taken in 13 schools to determine airborne asbestos concentrations. Airborne asbestos was found in one school in a concentration of 0.04 fibers per cc of air.

Reports of the ongoing statewide study will be prepared as appropriate to record the overall effort.

JCB:sf

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STATE OF MICHIGAN
DEPARTMENT OF PUBLIC HEALTH
3500 N. LOGAN, P.O. BOX 30035, LANSING, MICHIGAN 48909

WILLIAM G. MILLIKEN, Governor
MAURICE S. REIZEN, M.D., Director

December 20, 1978

TO MICHIGAN SCHOOL SUPERINTENDENTS

Ladies and Gentlemen:

Recently developed scientific evidence indicates that exposure to minute fibers of asbestos significantly increases the incidence of certain types of pulmonary cancer. More recently, an investigation in a number of schools in New Jersey has established that spray asbestos coatings on ceilings and walls and insulating pipe coverings can be sources releasing such particles to float in the air, particularly when the integrity of the asbestos surface is disrupted.

While an initial pilot study of some 200 schools in Michigan in January 1977, by the Department of Public Health, indicated that this is apparently not a problem in Michigan, we feel that a proper evaluation of the situation requires that all school buildings be surveyed for a determination of whether or not asbestos exposure of the school children is occurring. Therefore, it is requested that you solicit the assistance of your local health department in the conduct of an asbestos survey of the school buildings to determine:

1. Was material used which was known to contain asbestos or was suspected of containing asbestos?

2. Is the material in a sprayed form under a roof which was open to occupied rooms or in the form of panels which are uncovered or unpainted and are subject to flaking and physical damage?

3. Was a returned air plenum or false ceiling area used as a return air path and the surfaces spray coated with fibrous insulation?

In those instances where such use of material known to contain asbestos or suspected of containing asbestos was used:

1. Suitable specimens, properly identified as to the locations at which they were obtained, should be sent to the Michigan Department of Public Health Bureau of Environmental and Occupational Health, for examination to determine whether or not they contain the critical asbestos material, "Chrysotile".

"Equal Health Opportunity for All"

2. If analysis confirms the presence of this substance, appropriate air monitoring will be carried out by the Bureau of Environmental and Occupational Health to determine the fiber content of the circulating air, if any, and the exposure hazard to the children.

In view of the undisputed risk of adverse health effects from inhaled asbestos fibers, even though small in amount and remote in time, we feel that the proposed survey is extremely important and merits full participation.

Sincerely,

John Porter

Dr. John W. Porter
Superintendent of Public Instruction
Department of Education

Maurice S. Reizen, M.D., Director
Michigan Department of Public Health

CC: Local Health Departments

MACOMB COUNTY HEALTH CENTER
LELAND C. BROWN, M.D., M.P.H.
DIRECTOR

MACOMB COUNTY HEALTH DEPARTMENT
43525 ELIZABETH MOUNT CLEMENS, MICHIGAN 48043
TELEPHONE: 469-5236

TO: Public and Parochial School Administrators

RE: Asbestos fibers in occupied school areas

FROM: Division of Environmental Health

DATE: January 18, 1977.

Recent newspaper articles have called attention to the potential health hazard resulting from exposure to asbestos fibers. While the hazard associated with asbestos exposure has been recognized for many years, these articles have suggested that a health risk may exist for school children in some unusual situations where construction materials containing asbestos may release fibers into school buildings.

Over the past few years the Michigan Department of Public Health,Division of Occupational Health has conducted a number of investigations to evaluate this potential health problem in schools, public buildings and in private homes. Experience gained from these investigations suggests that there are few circumstances where asbestos is used in construction in such a manner as to be later released to the air in the occupied space of a building.

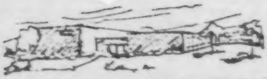
The use of asbestos in school construction is normally limited to blended materials used for sprayed on fibrous insulation and ceiling finishes. Since the primary health concern relates to the inhalation of asbestos fibers, the release of the fibers to the occupied space is necessary for the development of a health risk. It appears that the following situations in schools warrant evaluation where the presence of asbestos has been confirmed or is suspected:

1. The presence of sprayed fiber insulation under the roof which is open to occupied rooms or sprayed acoustical coatings which are uncovered or unpainted and subject to flaking and damage.

2. Return air plenums and false ceiling areas used as return air plenums where steel beams or wall surfaces are spray-coated with fibrous insulation.

Additional investigations are being conducted to further evaluate the situation in Macomb County Schools. Samples of construction materials suspected of containing asbestos as described above will be collected by a staff representative for x-ray defraction analysis. Where test results indicate the presence of a possible hazard, onsite studies will be undertaken to measure asbestos -in-air concentrations in occupied areas.

Please consult with your building and maintenance staff and notify this office of any school(s) which may contain sprayed on insulation or acoustical finishes.



MACOMB COUNTY HEALTH CENTER

LELAND C. BROWN, M.D., M.P.H.
DIRECTOR

MACOMB COUNTY HEALTH DEPARTMENT

43525 ELIZABETH MOUNT CLEMENS, MICHIGAN 48043
TELEPHONE: ~~[illegible]~~ 469-5236

REMINDER

TO: Macomb County Public and Parochial School Administrators

RE: Asbestos fibers in occupied school areas

FROM: Division of Environmental Health

DATE: April 13, 1977

In January of this year a communication from this office was sent to you relative to the potential health hazard resulting from exposure to asbestos fibers released by sprayed fiber insulation or acoustical coatings.

Kindly review our previous communication to determine whether any evaluative assistance by this department is indicated.

FM/ced

TABLE I
ASBESTOS FINDINGS IN MICHIGAN
12/15/76 - 12/31/78

	No. Examined	No. where asbestos suspected	No. where asbestos found	Insul	Other	Air
Schools	200+	64	20 samples in 18 schools	17	3	1*
Other	N.A.	36	10 samples in 7 places	6	4	0

Schools include Elementary, Intermediate, Jr., and Sr. High, one university and one private ballet school.

Others include residences, offices, government buildings and specific materials.

TABLE II
ASBESTOS SAMPLES BY LOCATION
12/15/76 - 12/31/78

	Schools and Universities	Other	Total
MATERIAL SAMPLES			
None Detected	61	33	94
1-10%	7	3	10
>10-20%	9	3	12
>20-30%	2	2	4
>30%	4	4	8
	83	45	128
AIR SAMPLES			
None Detected	33	6	39
0-1 fibre/cc	1	0	1*
	34	6	40

TABLE III
ASBESTOS SAMPLES BY MATERIAL TESTED
12/15/76 - 12/31/78

	Insulation	Ceiling Tile	Pipe Insulation	Other	Air
None Detected	72	14	2	6	39
1-10%	7	3	0	0	1*
>10-20%	7	1	2	2	0
>20-30%	2	0	0	2	0
>30%	7	0	0	1	0
	95	18	4	11	40

* 0.04 fibre/cc

TABLE IV
ASBESTOS SAMPLES IN SCHOOLS
12/15/76 - 12/31/78

	SCHOOL	INSUL	CEILING TILE	OTHER	AIR
1.	Michigan State University, East Lansing	0.0			
	Film Prod. Room	10.4%			
	Museum			10.4 (pipe insul)	
	Hanna Admin. Bldg.	0			
	Chem. Bldg.	0			
	Library	0	0		
2.	Cheboygan East Side Sch. Cheboygan	0			
3.	N. Muskegon High, Muskegon	4.8% (ceiling being removed)			
4.	Severo Ballet School, Birmingham	0			
5.	Nankin Mills Jr. High, Westland	7.6%, 0			0,0,0
6.	John Glenn High, Westland	0,0			
7.	Garden City West High, Garden City		0		
8.	Garden City East High, Garden City	0			
9.	Hamtramck High, Hamtramck	0			
10.	Tyrone School, Harper Woods	0			
11.	Dundee High, Dundee	0,0			
12.	St. John School, Monroe	0			
13.	Mark Twain School, Royal Oak	0,0			
14.	Anderson Jr. High, Berkeley	0			
15.	Norup Middle School, Oak Park	0			
16.	St. Michael School, Monroe	32.0%			0,0
17.	Bedford Inter., Monroe	11.8%			
18.	Mulick Park Elem., Grand Rapids		0		
19.	St. Mary's Parish, Monroe	71.8%			0,0,0
20.	Colony Elem., St. Clair Shores		0		
21.	Maxine Middle School, St. Clair Shores	0			
22.	Van Dyke Stadium	0			
23.	South Lake High, St. Clair Shores	12.5%			0,0,0
24.	St. Thomas Lutheran, E. Detroit		0		
25.	Fitzgerald Pub. Schools, Warren	0,0			
26.	Schofield Elem., Warren	0,0			
27.	Cantrick Jr. High, Monroe	0,0			
28.	Mound Pk. Elem., Warren	0,0			
29.	Westview Elem., Warren		0		
30.	Warren Sr. High, Warren	0			
31.	Mott Sr. High, Warren		13.0		0,0,0,0
32.	Green Acres Elem., Warren	0			
33.	Mason Central Elem., Erie	0			
34.	Whiteford Elem., Ottawa Lake		0		
35.	St. Mary's School, Bronson	10.0% (science room)			0,0,0,0
36.	Brownell Jr. High, Grosse Pte.	43.7% (pool area)			0,0
37.	Three Rivers High, Three Rivers	0			
38.	Davison Sr. High, Davison	13.6% (maintenance shop) 23.7% (auditorium)			0,0

TABLE IV--CONTINUED
Page 2.

SCHOOL	INSUL	CEILING TILE	OTHER	AIR
39. Hemlock Elem., Hemlock	3.8%			0,0
40. Romulus Sr. High, Romulus	0			
41. Eastern Elem., Grand Rapids			0,0 (pipe insul)	
42. Bedford Inter. School, Temperance				0,0
43. Coit Elem., Grand Rapids			12% (pipe insul)	
44. Clintondale Comm. School, Clintondale			0,0 (paper maché)	
45. Coldwater High, Coldwater	0			
46. Macomb Inter. Mt. Clemens		0		
47. Warren Woods High, Warren	0			
48. State Tech. Inst. Dental Room			42.9	
49. Winans Elem., Lansing		9.6		
50. LCC, Fin. Aud. Dept., Lansing			0 (settled dust)	
51. Oakdale Dev. Dis., Lapeer	0,0			
52. Galesburg Elem. Schools, Galesburg	28.1%			0,0,0,0
53. Roseville High, Roseville	9.7% (gym foyer)			
54. Lansing School System, Lansing	0			
55. St. Thomas Aquinas, E. Lansing	10.1%			0.04 fibre/c
56. Pioneer High, Ann Arbor				0,0
57. S.W. Elementary School, Flint	0			
58. Akron Fairgrove H.S., Fairgrove	0			
59. Williams Elementary School, Jonesville	0			
60. Lanse Creuse Mid. Schl., S., Mt. Clemens	0			
61 S.A.C.C., MHC, Melvindale	0, 11.8%			
62. Wayne State University, Detroit	7,8%			
63. Baldwin Community School, Baldwin	0			
64. Alma College, Alma		0		

TABLE V
ASBESTOS SAMPLES - MISC.
12/15/76 - 12/31/78

PLACE--ITEM	INSUL	CEILING TILE	OTHER	AIR
1. 241 Building, East Lansing	13.5%			0,0,0
2. Cooper residence, Parchment			28.8%	0
3. Fire blankets, East Lansing			21.0% 17.0% 14.0%	
4. Kingsford Apts., Kingsford	0			
5. Celotex Corp., Lanse		<4% <4%		
6. Carrigan residence, Ann Arbor	0			
7. WJIM - TV, Lansing	0,0			
8. Police Firing Range, Dearborn Hts.	0			
9. MSP Mobile Office, East Lansing		0		
Emerg. Services, East Lansing			0 (dust in air plenum)	
10. Mark Dale, M.D., Warren	0			
11. Chicago Pneumatic, Madison Hts.	0			
12. Ingham Med. Center, Lansing	0			
13. Mich. State Capitol, Rep. Bennett, Room 118		0	0 (carpet dust)	0,0
14. Mich. State Hwy. Dept., Coldwater	0			
15. Phillips residence, East Lansing	0		0 (settled dust)	
16. Lansing Civic Center, Lansing		0		
17. Clarence Fox, MDL, Lansing	52.8%			
18. Detroit Bldg., Maint. Divn., Detroit	0			
19. Bridge & Collins Office, Negaunee		0		
20. Lenawee Co. H.D., Adrian	0			
21. Cntr. for Pub Acctability, Lansing	0			
22. First Cong. Church, Romeo	0			
23. Kerrin Hoban residence, Ann Arbor	0			
24. City of Flint			0 (plaster)	
25. Lawrence D. Newman residence, Dearborn	0			
26. Thomas A. Duke residence, Farmington Hills	0			
27. Wayne Co. Hlth. Dept., Eloise				
Lunchroom	51.7%			
Basement area	53.7%			
28. City of Dearborn, Transp., Dearborn	0,0			
29. Lakin & Worsham, Southfield		0		
30. Marchese residence, Mt. Clemens	0			
31. Kenneth Duma residence, Brighton	0			
32. John Johnson residence, Detroit	53.6%			
33. MDL, Lansing	0			
34. Kathleen Thor residence, Coloma	0			
35. Mrs. Al Storm residence, E. Gr Rpds	0			
36. Mich. Ed. Assn. Office, E. Lansing	8.6%			

TABLE VI
SUPPLEMENTARY ASBESTOS FINDINGS

2/71 - 12/14/76

	No. Tested	No. Where Asbestos Found
Schools	5	0
Others	4	0

Chairman **Perkins**. Dr. Jensen, do you agree with Mr. Jager that if the asbestos material is secure and contained, that removal is not necessary?

Dr. **Jensen**. Yes, in general I would agree with that.

Chairman **Perkins**. But what about if it is sagging, broken loose and so forth, then you would say it should be removed?

Dr. **Jensen**. Again, if it were sealed by some technique which would prevent it from entering the environment, then I would say you could use some sort of a sealing method—that is s-e-a-l-i-n-g in this case—which, as long as we can prevent the material from getting into the atmosphere where a person can breathe the dust, that should be an effective means of control.

Chairman **Perkins**. Are you telling us that in some instances it will be better to seal it than undertake the removal?

Dr. **Jensen**. That probably would be the general case, rather than the exception.

Chairman **Perkins**. Any further questions, Mr. Buchanan?

Mr. **Jager**. Mr. Chairman, if I could add something to my statement, which may not have been too clear on that point, we feel that in most situations there will be a technique to secure the material. We do envision there may be circumstances such as you describe where the material has been damaged, it is falling down, it is in disrepair, where the sealing technique would not be a satisfactory solution and there may be instances where removal would be the more prudent alternative. We haven't found any of those in our State.

Dr. **Jensen**. May I make another statement which I hope is pertinent?

You have been hearing many people talk about measuring and evaluating the concentration of asbestos in the environment. First, that is an extremely expensive technique and the problem is, I would challenge anybody to tell me what are you going to do with the information once you have collected it, because, first, there is no known concentration which is acceptable; so the expenditure for sampling now may not be an index of what is going to happen tomorrow in the schools.

We know the older the building is the higher the probability this material is probably going to drop from the ceiling and so forth in the future. So, to me, sampling would be basically a waste of time. It may be an interesting academic exercise, but since we would not be able to use the information for practical purposes, I can see no reason for going out and spending a lot of money to measure and evaluate the airborne concentrations.

So it would appear that we need to know whether the material is present, is there a reasonable probability that it is going to get into the environment, and then make sure it doesn't.

But the immediate, probably most significant exposure in schools, I would think, is probably in the industrial arts classes, where students are being taught how to change brake linings of cars, because of the technique that they use to blow the dust out of the old brake drum.

Mr. **Buchanan**. I want to thank you both for your very excellent testimony and also commend you for your leadership in Michigan.

Do you have any concept of cost, or do you have any comment on our discussion toward some kind of Federal assistance to schools and the costs involved in it?

Mr. **Jager**. No, sir. I listened with interest to the testimony on costs this morning. We have absolutely no estimates on the cost of these repairs.

Chairman **Perkins**. Let me thank you, gentlemen. You have been very helpful to the committee. You made good witnesses.

Chairman **Perkins**. Our next witnesses, our next panel, is Dr. Norbert Page, Director, Health Review Division, Office of Toxic Substances, Environmental Protection Agency; and Dr. David Rall, Director of the National Institute of Environmental Health Sciences, Department of Health, Education, and Welfare, accompanied by Mr. William Blakey.

Come around, gentlemen. We will hear from you first, Dr. Page.

STATEMENT OF DR. NORBERT PAGE, DIRECTOR, HEALTH REVIEW DIVISION, OFFICE OF TOXIC SUBSTANCES, ENVIRONMENTAL PROTECTION AGENCY; DR. DAVID RALL, DIRECTOR, NATIONAL INSTITUTE OF ENVIRONMETNAL HEALTH SCIENCES, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE; ACCOMPANIED BY WILLIAM BLAKEY, DEPUTY ASSISTANT SECRETARY FOR LEGISLATION (EDUCATION)

STATEMENT OF DR. NORBERT PAGE, DIRECTOR, HEALTH REVIEW DIVISION, OFFICE OF TOXIC SUBSTANCES, ENVIRONMENTAL PROTECTION AGENCY

Dr. **Page**. Good morning, Mr. Chairman; or good afternoon, I guess, just about.

Members of this subcommittee, I am pleased to be able to come before you this morning. I don't have a presentation to make.

Chairman **Perkins**. That is all right. We are glad to hear your oral presentation.

Dr. **Page**. I understand there are certain technical issues that you would like to discuss.

I am Director of the Health Review Division of the Office of Toxic Substances in the Environmental Protection Agency. The Division is currently undertaking a hazard evaluation of asbestos, so I would be delighted to answer any of the technical questions you may have on the health aspects.

Chairman **Perkins**. All right; Dr. Rall, you go ahead.

STATEMENT OF DR. DAVID RALL, DIRECTOR, NATIONAL INSTITUTE OF ENVIRONMENTAL HEALTH SCIENCES, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE; ACCOMPANIED BY WILLIAM BLAKEY, DEPUTY ASSISTANT SECRETARY FOR LEGISLATION (EDUCATION)

Dr. **Rall**. Thank you, Mr. Chairman.

You know Mr. Blakey who is accompanying me.

I have little to add to our testimony of Monday.

Chairman **Perkins**. Of last week.

Dr. **Rall**. Perhaps a few points:

As we know, the authorities within HEW appear to be limited to two, one residing within the National Cancer Institute's Division of Cancer Control, and plans for the demonstration project that I discussed last Monday are well underway.

In addition, the Division of Cancer Control is considering a competitive program of demonstration projects with the total amount of dollars to be committed of $2 million.

In addition, you are aware of the special projects discretionary fund available within the Office of Education.

I really am delighted to comment that after your hearing last Monday representatives of HEW and EPA met long after the hearing and reviewed in great detail EPA's proposal to ensure that our coordination would be as effective as possible.

And let me just make one further comment: It was their sense—and I agree completely—that the record of Monday's hearings might be a most valuable document to distribute to the school boards. It really contains excellent, up-to-date information on the scope of the problem; the approaches to control, and might be a very, very useful way of informing the school boards throughout the country.

Mr. Blakey, would you care to comment?

Mr. BLAKEY. No.

Chairman PERKINS. Dr. Rall, approximately how much money is now available under Section 403 of the Public Health Service Act and under the Commissioner's discretionary fund in the Elementary and Secondary Education Act? The letter from the Department I received this morning mentions these are the only possible authorities to take care of this problem. Do you know how much money?

Dr. RALL. Let me answer for the National Cancer Institute. About $69 million.

Let me say, however, much of that is committed to such important problems as the Tyler, Texas, asbestos episode some years ago, following workers in vinyl chloride plants.

Chairman PERKINS. Is that authorization large enough that we could go before Appropriations and secure additional funding if Appropriations saw fit to grant us more money?

Dr. RALL. If I may correct the record, it is my impression the authorization is about $100 million. The authorization is $90,500,000, of which appropriated was about $69 million.

Chairman PERKINS. All right. Mr. Miller, any questions?

Mr. MILLER. Thank you, Mr. Chairman.

I don't quite understand, Dr. Rall, when we are done with the demonstration program, what are we going to have in hand?

Dr. RALL. We will have, I hope, three broad categories of things in hand: First, we will have a series of films and written material to aid schools in dealing with different types of asbestos problems, the sprayed steel beams, the sprayed ceilings and so forth. This can be made rapidly available in terms of trying to help the local boards of education understand how to approach their probelm and what to do.

Now, secondly, there is an issue that has come up but has not been surfaced, and that is, when you seal asbestos in a building that may be a very effective way of protecting the children while that building stands or while it stands unrenovated; but are we going to remember, 15 years from now when somebody comes in and renovates that building, that that is asbestos sealed up in the ceiling? We want to develop management techniques for identifying that as asbestos and being sure that the next generation doesn't fall into the same problem we have. Corporate memory, institutional memory, is often not very good.

Thirdly, we want to attack through this demonstration the quality control problem. If you send a sample from a ceiling to three different contractors, do they come out with the same correct answer, or are some very, very inaccurate?

Mr. **Miller**. Well, what time period are you talking about?

Dr. **Rall**. On this one we are working very hard. We have the collaboration of the Occupational Safety and Health Administration, because the workers are involved, the contract workers. It should start before summer vacation, which is the vital time, and be available then next fall.

Mr. **Miller**. Be available next fall?

Dr. **Rall**. Yes.

Mr. **Miller**. So you don't envision any major repairs or removal taking place prior to conclusion of the demonstration program?

Dr. **Rall**. Well, I think the Sawyer-Nicholson documents and the EPA document which, I gather, is about a month away, would be available for those schools that were able to proceed this spring or this summer.

Mr. **Miller**. Then I am not clear. If that is so, then why would we spend $2 million on a demonstration program when, in fact, schools would be capable, apparently, to properly do the job prior to the completion of the demonstration program?

Dr. **Rall**. I think the issue is how good a job are they going to do.

Mr. **Miller**. Should we allow anybody to proceed prior to the completion of the demonstration program?

Dr. **Rall**. If they follow the Sawyer-Nicholson proposals, they will do a good job. We hope there are ways of doing it more efficiently, more rapidly, less expensively, and to make better teaching and training material available to those schools that want to do it.

Clearly, there has to be an end to demonstration programs. After you have demonstrated it so many times, that is enough, and I think the amount of funds that the Cancer Institute is proposing for demonstration—which is its only authority—is probably about right.

Mr. **Miller**. It appears that one of the problems that local districts are going to encounter is one of determining the fact that building materials contain asbestos because apparently it can run from less than a percent to—I think we heard testimony last week—70, 75 percent asbestos.

You mentioned quality control, to determine how the school district can make a determination. How do you envision this testing taking place? Should this be done in private labs or should we set up regional labs for a period of a year, where people can send samples? Is it conceivable that with four or five labs you could deal with the samples that school districts send to you as to whether or not asbestos is contained in these various building materials?

Dr. **Rall**. I think the first approach is, there are a moderate number of commercial laboratories that are performing this service. We are working very closely with EPA to set up round-robin tests.

Clearly, I think there would be a need for greater testing capacity in the near future. I am not prepared at the moment to suggest how we should get that. Certainly, the free enterprise system will work. There will be other labs that——

Mr. **Miller**. I am sure there will be other labs. My concern is that they will know what they are doing.

Dr. **Rall**. Yes. That is why the quality control part of the demonstration grant and the proficiency program that HEW and EPA are working on is absolutely critical. You must simply know whether there is asbestos or not, and you must have good sceintific data to base your decisions on. I think that is the key.

Again, I don't think—as has been said before—that the air levels are that meaningful. Simply, the sample of the material is what is important.

Mr. **Miller**. Would it be fair to say that school districts can make a different determination on the school that had a three to five percent factor of asbestos in the sprayed-on material, as opposed to a school that had a 70 percent factor? Would that be a rational determination for a school district to make?

Dr. **Rall**. That would set the priorities; but I think——

Mr. **Miller**. It could be one of the factors in setting the priorities, so that information is available?

Dr. **Rall**. Which you would attack first.

Mr. **Miller**. Okay.

Chairman **Perkins**. Mr. Weiss?

Mr. **Weiss**. No questions.

Chairman **Perkins**. Let me thank you, gentlemen. You have been helpful to the committee.

Our last panel is Mr. Calabrese and Dr. Irving Peterson.

Come around, gentlemen. Are they here yet, Dr. Irving Peterson and Mr. Vincent B. Calabrese, Department of Education, State of New Jersey—are those people here yet?

Mr. Miller will take charge of the committee at this time.

Mr. **Miller** (presiding). We just finished talking about that, in setting priorities, one of the pieces of information that would be helpful is the percentage of asbestos present. What other kinds of information—because I fear that while some scientists would suggest that is not what we want to do, just because of the monetary implications, we are going to have to set some priorities, and where the funds should go first. Whether it is a loan or a grant program, or what-have-you, whether, if you feel qualified to testify, what other items—I mean state of disrepair comes to mind—that you would want to look to see what is going on; the form that asbestos is used in, its proximity, I assume, to students—what quality—go ahead.

Dr. **Rall**. Let's take it the other way. If you have asbestos in a very firm hard ceiling structure that, first of all, is not particularly accessible, or is so firmly bound or cementitious, as they call it, that it is very solid, I think that would be a very low priority.

Now, I think eventually that should be sealed, but I think that would be at the bottom of the priority of asbestos-containing material.

Then I think you would go to the friable material which can easily be broken apart, but either it is in a place that is relatively inaccessible or it is high enough, or somehow that is not going to happen. The potential is there. It is friable, but it has not yet started to deteriorate. That would be a middle priority. The highest priority, I think, is clearly what you can see, a deteriorating ceiling, accessible to the students, accessible to the maintenance worker. That, it seems to me, is the first order, and those, I think, likely will have to be removed rather than just sealed.

Mr. MILLER. Okay. Because I think at some point we are going to have to give school districts some guidance in terms of where they can apply—no matter what moneys we come up with, it is going to be rather limited in scope.

I think our other two witnesses are here.

STATEMENT OF VINCENT B. CALABRESE, ASSISTANT COMMISSIONER FOR FINANCE AND REGULATORY SERVICES, DEPARTMENT OF EDUCATION, STATE OF NEW JERSEY; AND DR. IRVING PETERSON, DIRECTOR OF FACILITY PLANNING, DEPARTMENT OF EDUCATION, STATE OF NEW JERSEY

STATEMENT OF VINCENT B. CALABRESE, ASSISTANT COMMISSIONER FOR FINANCE AND REGULATORY SERVICES, DEPARTMENT OF EDUCATION, STATE OF NEW JERSEY

Mr. CALABRESE. Before we review some specific problems in New Jersey, I would like to set certain historical facts in perspective. For example, in 1907, the first case of health problems related to asbestos was discovered. At that time, apparently a connection was found between certain cases of shortness of breath and asbestos.

In 1918, insurance companies stopped insuring asbestos workers in the industry.

In the 1930s, English medical research linked asbestos and lung cancer.

In the 1940s, cancer was more positively linked to asbestos exposure.

In the 1950s and 1960s, the extensive use of asbestos found its way into the construction industry, due in large part to its low cost, easy accessibility, its superior fire-retardant qualities and lightweight construction qualities.

In the late 1960s, Mount Sinai research was published, detailing the health hazard posed by the material.

In 1973, the Federal Government banned spray applications containing more than one percent of asbestos by weight.

This data would appear to indicate that the potential hazards of the material were well known long before the widespread use of it. Architectural and engineering firms recommended the use and the public relied on their advice and built into their buildings a dangerous substance. Federal environmental agencies did not actively move to ban the use until after some local agencies acted. I am sure the reasons for the inaction were due to inadequate or what was considered inconclusive evidence as to the potential danger.

We are now in the late 1970s. I am afraid that that particular situation still exists. We still have what is considered inadequate and sometimes inconclusive evidence as to potential danger. We are no longer building in the hazard and are now working to eliminate it. However, the body of technical knowledge is too often contradictory or lacks definite focus.

I think if there is anything a committee of this nature can do, is to just clear up or attempt to clear up the various differing opinions, different advice, received by the States over the last several years. For example, in 1974, I was at a college at that time, and we were advised that should the asbestos material be removed following existing Federal guidelines at that point in time there would still be microscopic particles in every nook and cranny of the building. These particles would infiltrate the atmosphere and thereby endanger the health of the occupants for the life of the building. More recently, we have been told that removing asbestos following new Federal guidelines is a suitable and permanent solution.

There are other uncertainties concerning enclosing the materials structurally or using drop ceilings or the effectiveness of paints or other sealants. It is our understanding that a Federal Environmental Protection Agency study is being conducted by Battelle Institute in Columbus, Ohio. They are in the process of screening 74 sealants at the present time. There is much interest in the use of sealants, but we have no knowledge as to when the information will be released.

State and local government need the assistance from the Federal Government to identify the safest procedure to follow in schools where asbestos has been used. We need to know clearly the safe or unsafe levels of asbestos content in such sprayed-on materials. We need to know specific corrective measures which can be implemented immediately so that schools can remain in session for long terms, so asbestos will not be a health hazard during the life of the building. This information could be invaluable in those States that have not yet experienced an asbestos fallout scare. It is too late for New Jersey. We have already decided there is no acceptable level of asbestos contamination of schools in our State. This is based more on the emotional reaction to the discovery of asbestos and to any specific scientific or engineering study that we can cite as conclusive proof.

Asbestos has been used in New Jersey schools primarily for thermal insulation and acoustical purposes. Sprayed-on surfaces vary from being thick and spongy to installations which are thin and hard. Where such sprayed-on asbestos materials have been vandalized or damaged through accidents or water damage, air samples have verified the release of fibers into the surrounding air. It has been where the material has been undisturbed, and in apparent sound condition, we have been told that there is still a gradual release of fibers from fallout. Such gradual contamination does not show up in air samples.

Since sprayed-on material can be easily damaged, intentional or unavoidable contact during maintenance and repair activities result in the release of asbestos fibers which can be measured by air concentration tests.

We have also been told that asbestos fibers which have fallen onto interior surfaces can repeatedly cause contamination of the environment as the disturbance of settled fibers causes resuspension in the atmosphere resulting in high fiber count in air samples. But while we are being warned of the release of asbestos fibers, we are also told that many if not most asbestos fibers are too small to be measured by air concentration tests and that the air sample procedures lack standardization and no standards have been developed for application to schools. We have also been told there is no percentage level of asbestos as a fraction of the overall sprayed-on material which has been determind to be a safe level.

At the present time, the only advice we have to offer local school districts, which is hard advice, that can be documented by the evidence, is to read all available literature on the subject to become aware of the potential hazard of asbestos, use current clean-up and repair procedures to reduce the creation and disbursement of dust intermixed with microscopic asbestos particles, monitor the activities in all areas containing sprayed-on asbestos materials and minimize intentional or accidental damage, do not apply any covering until more information is received from the EPA from studies being conducted by the Battelle Institute, and remove asbestos material wherever it has been damaged or has deteriorated for any reason and is visibly flaking.

This leaves the responsibility for deciding appropriate action completely in the hands of local school officials. This has caused considerable variation from district to district in the implementation of guidelines. And it has placed local school officials under tremendous pressure from concerned parents. The best solution would be for the Federal Government to make those specific determinations we have mentioned before. Anything short of a unified and consistent policy on this matter at the Federal level will perpetuate the confusion, uncertainty and variability in action by each of the separate States.

At the current time, the only funds available in New Jersey for this purpose would be local revenues raised by referendum. Our school districts, along with all other units of government, have been capped. We out-propositioned Proposition 13 long ago. Surplus funds are disappearing. The only way large amounts of funds can be raised is through these local referendums mentioned. Referendums are no longer easily passed. The population is aging, and senior citizens are suspicious of any proposals that cost new tax dollars. This makes the possibility of defeating future issues real.

We are currently reviewing the feasibility of a State initiative to help fund the problem. Unfortunately, the State is also facing the possibility of a major budget gap and searching for ways to reduce the budget and find new revenue resources.

Although I am sure you have heard this a thousand times, there is a critical need for a Federal initiative in this area. This initiative, if it is to be effective, must come soon. The issue is emotional as well as technical and varies from hysteria to rage against government generally by people who feel that they have been affected by the problem.

Aid should be retroactive and should not penalize those districts who have acted promptly to protect the health of their citizens.

As an aside, when we were at the college and had the problem, we were told at that point that the responsibility begins at discovering these cases, that there is no such thing as a statute of limitations. This means the number and amounts of future lawsuits will, in all probability, exceed many fold the cost of removing the hazard.

While we should never act in the national interest only to save money, we should point out to any tight-money advocates who raise the spectre of funding they may very well find the delay has and will be infinitely more costly.

In New Jersey we have 250 known schools with sprayed-on materials containing asbestos, involving approximately 2.5 million square feet. We suspect that when we finally begin to re-look at the problem, we may find many more. In these cases where the material has been hidden, where it wasn't easily ascertainable, we may find that, when funds are available and districts begin to take another harder look, we may find there are more than 250 schools. To remove this material and replace it with suitable fire-retardant or acoustical treatment would cost the taxpayers of New Jersey around $15 million as a minimum, and that is at $6 per square foot. I heard a $12 per square foot figure this morning in Kentucky. If so, that would be up to $30 million, and if we have as little as 150 more schools with the same problem, it would be somewhere in the $50 million-$60 million area.

Projected for the entire country—well, we can all do our math—it would be a considerable amount of money, approaching possibly $1 billion.

The magnitude of the burden suggests there is an urgent need for Federal involvement in funding for corrective action in schools, once suitable procedures and guidelines have been established by the Federal Government.

Thank you for listening to us. You are to be congratulated for attempting to define the issue and find a solution. I only hope as a result of your hearings we can start at an early date.

Mr. BUCHANAN. I want to thank you for your testimony. I think you have identified a problem that is a real one. There are certain places where the public reaction is so strong that it is too late to do the things which in many other places might be done. The fact that you in New Jersey have let the world know about the problem and your experience, I hope, will contribute to a national attack upon this problem and finding the means, in an atmosphere of calm and rationality, to both thoroughly and logically attack the problem in other places. I know you have been through a hard time with this. I hope your experience is going to be helpful to others.

Mr. CALABRESE. As I mentioned before, if there is anything you can do to produce this calm atmosphere, it would be to comfort with clear advice as to levels, clear advice as to procedures, for the Federal Government to take the initiative in setting forth what it considers safe levels and safe procedures. Currently, the industry feels it is too restrictive, that the danger is not as great as people make it. Local people feel the danger is completely real. There may be something in between. I think it is a Federal job to move into that gap.

Mr. **Weiss**. Mr. Calabrese, I, too, want to thank you for your testimony. I think it presents a very good perspective on the problem.

Suppose the Congress—taking into account the mood of the Congress, the administration, and the country—finds itself incapable of undertaking any kind of fiscal, financial assistance in this area. Do you believe that the localities will, in fact, deal with the problem, or will the problem be ignored at the local level?

Mr. **Calabrese**. I think once the problem is discovered, that the public and the system, itself, will force the municipal, local officials to act. I think inaction, under capped budgets and going into referendum, in effect we will be moving money from the program side of the budget to the repair side of the budget and, in effect, asking our kids to finance the health hazard by lowered available funds in the regular programs.

I am saying the local government will act. It will have to act. There is no way of not acting. It will just put a further strain on already limited resources at the local levels, and they have the least capability of raising large amounts of funds over broader numbers of people.

Mr. **Weiss**. Thank you very much.

Mr. **Miller**. Dr. Peterson, have you anything to add?

STATEMENT OF DR. PETERSON, DIRECTOR OF FACILITY PLANNING, DEPARTMENT OF EDUCATION, STATE OF NEW JERSEY

Dr. **Peterson**. I have nothing further to add except to repeat what has been said already. We have been walking on eggshells for two years, and we do need some help in the way of positive direction.

Mr. **Miller**. Mr. Calabrese, as I understand your testimony, you are not under any specific Federal mandate in this program in terms of standards. You have had conflicting direction as to what is safe and what isn't safe, but there is no specific Federal mandate level which you must meet; is that correct?

Mr. **Calabrese**. That is right. As I say, that is part of the problem.

Mr. **Miller**. The threat, then, is really one that, at some point down the road, you could be hit with a lawsuit for not just exercising due caution in terms of—now that the risk is known, or some risk is known—in regard to those students. Isn't that correct?

Mr. **Calabrese**. I think I mentioned that was a problem that I encountered at a college where, by the threat of a lawsuit, was present, and I think we have had at least one in New Jersey that was finally dropped because of inconclusive evidence.

Mr. **Miller**. My concern would be, I am not sure if we wanted to, and I am not sure that we should, establish a Federal standard that tells you what parts per million you can have, because nobody agrees what parts per million is, in fact, safe or not safe on the theory of—the threshold theory. So I guess, you know, at best, maybe, what this committee is going to be able to do is to help identify the problem and then let local districts approach that problem as they will, hopefully with some Federal funding help, but beyond that, I am not sure that we can certify that this school is now safe because—I don't want people to get the impression that that is what we will undertake to do, because I am not sure that we have the expertise, or that anybody does, to give you a clean bill of health.

Mr. CALABRESE. You may have to come to the same conclusion that we have, that there is no level that is safe, and it must be removed. I think that will be the final—probably will be the final answer to the problem.

Mr. MILLER. Are there further questions?

Thank you very much for your testimony.

The committee will stand adjourned at this point.

[Whereupon, at 11:45 a.m., the subcommittee adjourned, to reconvene upon the call of the Chair.]

[Additional material submitted for the record follows:]

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF THE
ADMINISTRATOR

Honorable Carl Perkins
Chairman, Committee on
Education and Labor
House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

Because of your demonstrated concern about the problems of asbestos contamination in schools, I am forwarding a report which I am sure will be of interest to you.

The Environmental Protection Agency's consultant in this area, Dr. Robert Sawyer, recently visited the Prestonsburg Senior High School in Prestonsburg, Kentucky, to evaluate the extent of asbestos contamination there. His report, which has been forwarded to the Kentucky Department for Natural Resources and Environmental Protection, is enclosed.

On January 8 and 16, EPA witnesses appeared at hearings chaired by you before the Subcommittee on Elementary, Secondary and Vocational Education on the problem of asbestos contamination in schools. We would also like a copy of Dr. Sawyer's report on the Prestonsburg High School to be included in the record of those hearings. I am therefore forwarding two copies of the report: one for you and one for the hearing record.

Sincerely,

Charles S. Warren

Charles S. Warren
Director
Office of Legislation

Enclosures

Mr. Eugene F. Mooney
Secretary, Department for Natural
  Resources and Environmental Protection
5th Floor Capital Plaza Office Tower
Frankfort, KY 40601

Dear Mr. Mooney:

As you requested on January 5, 1979, Robert Sawyer, M.D., consultant to the Environmental Protection Agency (EPA), has visited the Prestonsburg, Kentucky, Senior High School. Dr. Sawyer, Larry Dorsey of EPA, and Jack Wilson and staff of the Kentucky State Task Force on Asbestos in Public Schools inspected the school on January 16, 1979.

Dr. Sawyer has evaluated the condition of the sprayed asbestos-containing material in the school and the results of samples of that material. Dr. Sawyer's report, which recommends removal of the material at the earliest feasible date, is enclosed.

I hope that Dr. Sawyer's report assists you and members of the Task Force in your deliberations on this difficult problem.

Sincerely,

John P. DeKany
Deputy Assistant Administrator
  for Chemical Control

Enclosure

REPORT BY ROBERT N. SAWYER, M.D., ON ASBESTOS IN PRESTONSBURG HIGH SCHOOL

Background: In recent years, there has been increasing awareness of the significance of environmental contamination and disease causation due to asbestos. Asbestos materials are contaminants that affect both occupational and nonoccupational populations. Diseases associated with exposure to asbestos are pulmonary asbestosis and malignancies of the chest, abdomen, and other sites.

Most of the knowledge of asbestos-related illnesses comes from high exposure level situations. Because of a lack of specific data on low-level exposures and a lack of understanding on the mechanisms of cancer formation, an absolutely safe level of exposure cannot be established with certainty at this time. It is prudent that all unnecessary exposure to asbestos be eliminated and nonavoidable exposures be minimized.

Exposure levels considered potentially hazardous have been documented in buildings. Consideration of these findings along with the special characteristics of school populations has led to a specific concern over school buildings containing friable asbestos material.

Findings Specific to the Prestonsburg Senior High School:

1. Material: The subject material covers the overhead surfaces in the school corridors and a music room. The material is highly friable and is quite easily disintegrated with minimal force. The material condition is very poor with areas of failure quite evident especially on the first level of the school. Further, significant areas have been damaged and disrupted. Large segments of the ceiling material have been intentionally cut for installation of support members for new heating lines. There are also areas of damage and destruction that appear to have resulted from student activity. In general, the friable material has been significantly disrupted.

2. Analysis of the Friable Material:

a. The Division for Laboratory Services, Department of Human Resources, Commonwealth of Kentucky has reported that the material contains anthophyllite asbestos but has not estimated the percentage contained.

b. Our analysis shows chrysotile at 30 percent and amosite asbestos at 10 percent. I did not personally obtain this sample and will not attempt to explain our analytical results and the differences between the analyses at this time. We suggest that two samples from opposite corridors be obtained and submitted for examination. Dr. Arthur Rohl at Mt. Sinai has agreed to do the analysis.

3. Hazard Evaluation: The asbestos-containing material is within areas with heavy student activity and movement. The population of students is obviously active as evidenced by the damage observed. Thrown objects have penetrated the surface, handprints can be seen outside the gymnasium entrance, and stairwell surfaces are significantly damaged. The material is open, accessible, and severely disrupted over approximately 30 percent of its surface area.

4. Air Sampling: Air sampling in school exposure situations for purposes of hazard evaluation has only limited value. It is discussed here for two reasons. First, some investigators have placed significance on the results of air sampling. Second, there appears to be significant misunderstanding of the meaning and interpretation of the results of air samples taken at the school. A letter dated January 12, 1979, from B. F. Brown, M.D., of the Division of Laboratory Services cites the results of eight school building air samples and one blank sample. The results range from 0.08 to 0.77 fibers per cubic centimeter. The results in turn have been compared to the present Occupational Safety and Health Administration

(OSHA) time weighted average (twa) limit of 2.0 fibers per cubic centimeter. The inference drawn from the comparison was that the school asbestos exposure situation was not significant since the readings obtained were well within the industrial standard.

A more complete understanding of the factors involved in the comparison is needed.

a. The OSHA exposure limits have applicability to industrial situations, have an economic basis, and are not specifically addressed to the prevention of cancer.

b. The present standard of 2.0 fibers per cubic centimeter was established by regulations effective in 1972. Knowledge and awareness of asbestos exposure effects in causing cancer has increased significantly since that time. It should be noted that in 1975, proposed changes to the OSHA regulation on exposure to asbestos included lowering of the standard from 2.0 to 0.5 fibers per cubic centimeter. Then, in consideration of additional medical and epidemiological information, the National Institute for Occupational Safety and Health in 1977 recommended a further lowering of the standard to 0.1 fibers per cubic centimeter for industrial exposures.

OSHA Exposure Limits (twa)	Comparison to Prestonsburg Data
1972 2.0	Within OSHA limits.
1975 0.5	One sample taken in the first floor corridor near office exceeds the industrial standard.
1977 0.1	Seven of the eight samples exceed standard as recommended by NIOSH.

The use of industrial standards for a population of school children is quite inappropriate. However, since emphasis appears to have been placed on the comparison, it seems appropriate to also consider the proposed and recommended changes in these limits.

c. Perhaps the more significant question is comparison of asbestos levels within the school with those affecting the community outside the school. Unfortunately, such control data has not yet been collected. However, I anticipate with confidence that 0.0 readings will result. Thus, if it is reasonable that the exposure of school children to a carcinogen should be no more than that of the entire community in which they live, then a carcinogen exposure risk exists within this school building.

5. Abatement: There appear to be some misconceptions over the technique of asbestos abatement. I anticipate that with EPA's proposed guides and specifications, local workers

could effectively and safely carry out the asbestos removal operation.

Summary and Recommendations:

1. Asbestos has been implicated as a carcinogen and cocarcinogen with no safe level of exposure established with certainty. The most prudent approach to this situation is the elimination of all unnecessary exposure and the minimization of all unavoidable exposure.

2. Characteristics of both the asbestos mineral fibers and their disease potential in school populations have combined to create a situation of concern.

3. The disruption of the asbestos-containing material within the Prestonsburg School is severe, and the evidence of the contamination of the school environment is significant. Our studies have led us to over 100 school buildings in 10 States. The disruption of material in this building is one of the worst ever seen.

4. It is sincerely recommended that removal of the asbestos-containing material be undertaken at the earliest feasible date without regard to convenience of either the school population or the Board of Education.

WILLIAM R. COTTER
1ST DISTRICT, CONNECTICUT

WASHINGTON OFFICE:
2338 RAYBURN BUILDING
WASHINGTON, D.C. 20515
TELEPHONE: (202) 225-2265

WAYS AND MEANS
COMMITTEE

Congreſs of the United States
House of Repreſentatives
Waſhington, D.C. 20515

February 23, 1979

Honorable Carl D. Perkins
Chairman
Subcommittee on Elementary,
Secondary and Vocational Education
Committee on Education and Labor
House of Representatives
Washington, D.C.

Dear Mr. Chairman:

Mr. Geoffrey Mandly of 100 Price Boulevard, West Hartford, Connecticut, has contacted me concerning the health hazard posed by asbestos in the Hartford public schools.

In this connection, Mr. Mandly has prepared the enclosed reports on the asbestos problem at the Quirk Middle School where he teaches. He has asked me to forward this material to you for inclusion in the hearing record which your Subcommittee has established concerning this problem.

Thanking you for your cooperation, I am,

Sincerely,

Bill Cotter

William R. Cotter
Member of Congress

TAKE ONE -- READ IT -- PLEASE RETURN IT

ASBESTOS
AT
QUIRK MIDDLE SCHOOL

TO: The Staff of Quirk Middle School

FROM: Geoffrey Mandly - Room 308

RE: Asbestos Problem at Quirk Middle School

As you are probably aware, at least eight schools in the Hartford School System have been designated by the State Department of Education (School Building Unit) as schools with hazardous asbestos installations. Quirk Middle School is one of those schools so designated by the State Department of Education.

The following was a series of questions submitted to Mr. Joseph Tierinni, head of the Buildings and Grounds Department of the Hartford Public Schools, and to his assistant, Mr. Makati. The Buildings and Grounds Department recommends to the Hartford Board of Education the course of action to be taken in regard to the asbestos in the Hartford Public Schools. To many of the responses I have made a rebuttal or supplemented and clarified points based on research and facts. My responses appear in parentheses within the answer sections.

Q: Is there any asbestos fireproofing or insulating material at Quirk Middle School? If so, where is it located?

A: Yes, there is asbestos fireproofing in the school. It is located above all suspended ceilings on each floor (in the halls and in the classrooms) throughout the entire school building.

Q: The Connecticut State Health Department considers an asbestos content of greater than 1% in these fireproofing and insulating materials a potential health hazard - does the material at Quirk Middle School exceed this 1% level?

A: I am not sure of the exact level (at this point I made reference to a report submitted to the Hartford Board of Education on February 8, 1977. The independent report conducted by H. E. Murdock & Sons, Inc. in conjunction with Dr. Robert Sawyer indicated the type and level of asbestos in those Hartford schools designated as schools with hazardous asbestos installations. This report indicated that the level of asbestos in the fireproofing at Quirk Middle School was 15%, which far exceeds the 1% level set by the state. The accuracy of this 15% figure was questioned but it was conceded that the level at Quirk probably exceeded the 1% level).

Describe the air-return system at Quirk Middle School focusing particular attention on:

Q: What is a plenum?

A: A plenum for our purposes is the space between the suspended ceiling and the next concrete floor or the roof on the third floor that is filled with air.

Q: Where is the asbestos at Quirk located in relation to this plenum?

A: The asbestos fireproofing is located within the plenum in the space above the suspended ceiling.

Q: Is there a way for the air that comes in contact with the asbestos in the plenum to be returned to the classroom through the air duct system carrying with it airborne asbestos fibers?

A: Yes, the air circulating in a classroom exits the room through an open grating and enters the plenum where the asbestos fireproofing is located. Through negative air pressures, this air which comes in contact with asbestos is pulled (pushed) to the central air-handling unit where this air (depending on the temperature of the school relative to that of the outside air) enters through a damper, is filtered, and is pushed (pulled) back to the classroom through air ducts. Will the filters remove the airborne asbestos fibers? No, the filters will not remove the microscopic asbestos fibers.

We can assume that the Federal Environmental Protection Agency in 1973 prohibited further spraying of such asbestos-laden material in buildings because it was deemed a health hazard.

Q: Has asbestos been proven to be a carcinogen to humans?

A: Since I am unsure what the word carcinogen means, I can't answer the question fully (at this point I defined carcinogen as a cancer-producing agent. I pointed out that there is a direct link between exposure to asbestos and the development of mesothelioma - cancer of the pleura and peritoneum - and lung cancer.)

Q: What level of asbestos exposure has proven to be a health hazard to humans?

A: I really can't answer that question because I don't know. (Here, I made reference to a 1976 study conducted by the United States Department of Health, Education, and Welfare - National Institute for Occupational Safety and Health which stated that ". . . Excessive cancer risks have been demonstrated at all fiber concentrations studied to date. Evaluation of all available human data provides no evidence for a threshold or for a "safe" level of asbestos exposure." Again, the reply is that we really don't know.)

Q: What kind of physical disability is associated with asbestos exposure?

A: A type of lung cancer (mesothelioma, a tumor of the pleura and peritoneum. There is also an increased rate of lung cancer in persons who inhale asbestos fibers and smoke cigarettes - a 90 times greater risk of lung cancer. The effects of asbestos exposure are not immediate. The period between the first exposure and the development of cancer appears to be around twenty-five years.

The disease is associated with an extended period of illness and is almost always fatal.

On February 8, 1977, H. E. Murdock & Sons, Inc. (general contractors) sent a report to the Hartford Board of Education detailing its findings of the extent of the asbestos problem in the Hartford schools. The report stated in reference to the asbestos material found in Quirk Middle School that the material was "extremely friable and fiber dissemination highly probable".

Q: What does the above statement say about the condition of the asbestos material at Quirk Middle School?

A: I am unsure of the meaning of the word friable. (A discussion ensued over the meaning of the word and its application in the above-mentioned quote. The dictionary provided a guide - easily crumbled, brittle, easily pulverized or reduced to a powder. Thus, it would appear that friable, in the context so used by the H. E. Murdock & Sons, Inc. report, means that almost any vibrations, air currents in the plenum, or other trauma, would easily cause fibers from the asbestos material to break off from its present location and become airborne. This would have particular impact at Quirk since such asbestos material is located within the plenum and if dislodged becomes part of the air that is pushed (pulled) into the classrooms.) It was Mr. Makati's belief that the use of the phrase "material extremely friable and fiber dissemination highly probable" was a mistake by H. E. Murdock & Sons, and that they did not intend that the report concerning the asbestos at Quirk Middle School have that meaning; we really do not know how the investigation was conducted. (H. E. Murdock & Sons, Inc., when contacted, said they only collected the samples from the schools; any analysis of the asbestos was the responsibility of Dr. Robert Sawyer, Yale University Medical School, Professor of Preventative and Occupational Medicine. Since Dr. Sawyer is one of the foremost experts in the country on the dangers of asbestos we can assume that the phrase "material extremely friable and fiber dissemination highly probable" was used to describe the actual condition of the asbestos material found at Quirk Middle School in February of 1977.

Q: If this observation was made on February 8, 1977, is it possible that the condition of this asbestos material has deteriorated further to date?

A: We just don't know.

The Connecticut State Health Department - Division of Preventable Diseases put forth guidelines for the presence of asbestos materials in the schools. By applying these guidelines - which are based on three criteria: (1) total asbestos count of the material in question, (2) the condition of the material, and (3) location of such material - to the situation at Quirk Middle School, it would appear that the State strongly recommends removal of the asbestos at Quirk Middle School.

(A closer look at the criteria used by the State Health Department follows:

1. If laboratory analysis of the asbestos-bearing material indicates the presence of asbestos in a quantity greater than 1%, then further examination is required - approximately 15% at Quirk Middle School.

2. If, upon inspection, the asbestos material is flaking or is in a state of deterioration, it should be assigned a high priority for attention - at Quirk the "material is extremely friable and fiber dissemination highly probable".

3. High priority should be assigned to any asbestos-bearing material which by virtue of its location receives or is in danger of receiving physical contact, intentional or accidental, through the activities of any people using the building. Location is also of concern if the air containing the material is subject to vibrations or strong air currents, is the source of intake air, or is frequented by many people (emphasis supplied) - at Quirk students can and have pushed, punched, or broken ceiling tiles in various areas of the school exposing the asbestos material located above these tiles. Such material is also subject to strong air currents since it is located in the air plenum of the air circulating system of the school.

Using the above three criteria, the State Health Department considers Quirk Middle School a health hazard because of the presence of asbestos materials throughout the school. The Department recommends two procedures to eliminate the health hazard posed by asbestos: removal or containment with a solid barrier such as a false ceiling or wall. The only choice for Quirk Middle School appears to be removal. The State Health Department states (1) a solid barrier such as a false ceiling can be constructed only when the asbestos which it covers will not be subject to drafts or trauma and is not in an area of intake air, and (2) in no case will a false ceiling or wall be adequate if the area between the covering and asbestos area is used as an air plenum and where asbestos fallout can not be eliminated the asbestos should be removed.)

Q: Using the above three criteria, the State Health Department would recommend removal of the asbestos at Quirk Middle School; why then does the Hartford Board of Education adopt a fourth criteria (OSHA standard) which is allowed to override the recommendation for removal of asbestos at Quirk Middle School?

A: The Hartford Board of Education has to use some standard to measure the level of asbestos. The State Health guidelines are not specific and the Hartford Board of Education is not mandated to use the State Health guidelines. The OSHA standard is an accepted standard of levels of asbestos.

Q: What is the OSHA standard?

A: The OSHA standard is the permissible level of asbestos exposure for workers in the American work force as set by the Occupational Health and Safety Administration. The standard is 2 fibers per cubic centimeter greater than 5 micrometers over the course of a work day.

Q: How is the OSHA standard determined?

A: Not answered. (The Occupational Health and Safety Organization sets the permissible level of asbestos exposure based on research conducted by the National Institute for Occupational Safety and Health (NIOSH). After NIOSH conducts the research, it recommends to OSHA the permissible level of asbestos exposure.

Q: Has there been a revision of the level of asbestos exposure in the past or has there been a proposed revision of the present OSHA standard?

A: Not answered. (In 1972, NIOSH recommended a standard of 2 asbestos fibers per cubic centimeter greater than 5 micrometers in length. This standard was recommended with the knowledge that it would prevent asbestosis but *not* prevent asbestos-induced tumerous growths, but technology at that time could achieve such a standard. Instead, OSHA adopted a standard of 5 asbestos fibers per cubic centimeter greater than 5 micrometers. This standard was to be reduced to 2 asbestos fibers per cubic centimeter greater than 5 micrometers by July, 1976. As a result of a court case in 1975, OSHA decided to re-examine its standard. In December, 1975, OSHA requested NIOSH to re-evaluate the information available on the health effects of occupational exposure to asbestos fibers. NIOSH, as a result of its analysis recommended a standard of .1 asbestos fibers per cubic centimeter greater than 5 micrometers in length - a twenty-fold reduction from the present standard used by OSHA and the Hartford Board of Education. This standard was intended to (1) protect against the noncarcinogenic effects of asbestosis, (2) materially reduce the risk of asbestos-induced cancer - *only a ban can assure protection against carcinogenic effects of asbestos* - and (3) be measured by techniques that are valid, reproducible, and available to industry and official agencies. Although NIOSH made its recommendations in 1976, OSHA refused to lower its present standard of 2 asbestos fibers per cubic centimeter greater than 5 micrometers in length.)

Q: Could a greater concentration of shorter fibers be more hazardous than the present OSHA standard?

A: Not answered.

Q: What do you think about the statement by Pat Honchar who heads the Governor's Task Force on Asbestos that airborne tests like those conducted at Quirk Middle School are "completely irrelevant" and "are something we *never* recommend because they (airborne tests) do not apply to a non-occupational population"? (emphasis supplied).

A: Some standard has to be used to measure the level of asbestos. The OSHA standard is an accepted standard of the safe level of asbestos exposure. (A question was raised whether a less strict standard than the OSHA standard should be used since the OSHA standard applies to workers exposed to asbestos during processing, manufacturing, and use of asbestos and asbestos-containing products. In a conversation with Pat Honchar, she emphasized that the standard used should be more strict since we are dealing with a student population. A worker can decide whether or not to work at a particular establishment; children on the other hand have little or no choice especially since the student population at Quirk is generally economically disadvantaged.)

In the March 1, 1978 issue of the Hartford Advocate, it was reported that you (Mr. Tierinni) had records showing that the ceiling tiles at Quirk Middle School, among other schools, were "clipped in" four months ago.

Q: What does "clipped in" mean?

A: That means we put in a clip - it might even be a nail - which secures the ceiling tiles so that the tiles can not be pushed up.

Q: Have you confirmed your records?

A: I made a mistake when I made that statement. I was in a hurry and I don't know why I said they were "clipped in" because the ceiling tiles have not been "clipped in" at Quirk Middle School.

Q: Has your office been assured that precautions had been taken to protect students from exposure to asbestos in all areas of Quirk Middle School?

A: Yes.

The Hartford School System is not alone with its asbestos problem. At the height of public awareness, many of the school systems which had schools designated as health hazards by the State Health Department acted immediately to remove or cure the danger posed by asbestos exposure within these schools.

Q: Did these systems which have removed or cured the asbestos hazard use a prolonged airborne testing process?

A: Not answered.

Q: Has Hartford cured its asbestos problem?

A: Not answered.

Q: Has the Hartford Board of Education made any effort to assure confidence in the workings of the system and its responsiveness to the public by communicating the health hazard posed by asbestos or the progress made by the Hartford Board of Education to remedy this health hazard - to (1) parents of students affected (2) parent-teacher organizations (3) community at large (4) teachers?

A: Not answered.

The foregoing are the facts as they relate to the asbestos problem that exists at Quirk Middle School. From my point of view, this is one health hazard I am not willing to live with and I will not feel safe unless the asbestos is removed. So far my views are in the minority (as a matter of fact a minority of one). My intention in putting together this information was not so much to persuade the staff at Quirk that my position is the correct or the only position to take but to give to the staff at Quirk the facts concerning the asbestos problem at Quirk.

The staff has never been informed of these facts. Had it not been for the article in the Courant in the latter part of May, 1977, which designated Quirk as one of the schools in Connecticut with an asbestos hazard, I doubt we would have been aware of the asbestos in the school. The Hartford Board of Education itself became aware of the danger February 8, 1977, yet did not convey this to the schools affected. In response to this article, a memorandum was sent by Mr. Paternostro (the Chief Officer of the School Building Unit - State Board of Education) to Quirk Middle School which stated that the areas of asbestos exposure were the boiler room and the receiving area. This information was conveyed to the staff.

This information was incomplete and in my mind created a false sense of security because at the time of the memorandum Mr. Paternostro's office did not know that the air that came in contact with the asbestos was pushed into the classrooms. I became aware of this fact in repeated conversations with the Buildings and Grounds Unit of the Hartford Board of Education which I subsequently relayed to Mr. Paternostro's office. At the time of the memorandum, then, the Hartford Board of Education was aware of the likelihood that students and teachers were exposed daily to asbestos fallout in the classrooms, but made no attempt to correct the false sense of security created by the memorandum. This fact has never been communicated to the staff and students at Quirk.

There is asbestos above your classroom, there is asbestos fallout in your classroom, and asbestos causes cancer. What you do with these facts is up to you. But remember that asbestos is not just another saccharin scare. Unlike the cancer-producing property of the artificial sweetener saccharin, which was discovered by tests on laboratory animals, the fact that exposure to asbestos causes cancer is backed by dead bodies. You have probably noticed the increasing number of commercials on television alerting those people who were/are shipbuilders, construction workers, insulation workers, steamfitters, carpenters, auto mechanics and the like to seek immediate medical attention if there is any sign of a respiratory problem. What these workers had in common was not their occupation but the fact that they were exposed to asbestos. The deceptive aspect of asbestos exposure is that its debilitating effects do not manifest themselves immediately. You may feel fine today, or tomorrow, or next week, or next month, or a year, five years, ten years, fifteen years, twenty years from now, but between twenty-five years and thirty-five years after exposure, tumorous growths can begin to form in the lining of the chest cavity. Mesothelioma as noted is almost always fatal.

Some of you are probably calculating how old you will be twenty-five or thirty years from now. I did and the prospect of spending my hard-earned retirement gasping for breath in a hospital bed was disheartening. The burden on the rest of your family of such a debilitating disease can not be measured. Even if you are fatalistic and think you will die before mesothelioma can manifest itself, you should think about your family. No, mesothelioma is not contagious, but you can unknowingly create an environment conducive to lung cancer. Workers who are exposed to asbestos unknowingly carry asbestos fibers home on their clothes. Family members who come in contact with such clothes can develop mesothelioma. This fact was vividly documented recently (July, 1978) on ABC's News Closeup television documentary - "Asbestos - The Way to a Dusty Death". A man who was exposed to asbestos at work died of lung cancer, his wife died of mesothelioma, and his daughter, now a young mother herself, was dying of mesothelioma. This is not a very pleasant scenario, but it has been predicted that the number of people dying of mesothelioma will soon reach epidemic proportion because of the heavy use of asbestos between 1945 and 1973 (see article page 12).

Even if you are willing to assume this asbestos risk in the workplace, should the students in your class have to assume this same risk? How old will they be twenty-five or thirty years from now? When difficult education decisions have to be made as teachers we ask ourselves, what would be the best for the students? If we are not willing to compromise the quality of their education, should we be willing then to compromise the quality and safety of the environment within which they receive their education.

If you do not think that the problem is one that requires immediate attention, then you are not alone. Even though the Buildings and Grounds Department realizes the only positive solution is removal of the asbestos, the department would not remove the asbestos unless either ordered to do so by a regulatory agency or where airborne tests exceeded the OSHA standard. These airborne tests were to be conducted annually. The first test was done in August, 1977; to date no further airborne test has been conducted by the Hartford School System.

Kate Campbell of the Hartford Board of Education, does not think the problem is an urgent one, either. When contacted in February of 1978, she showed no interest in the subject even though her son at the time was attending Quirk Middle School.

Nor is the State Health Department in a hurry to clear up the problem. Despite Pat Honchar's pronouncements on the danger posed by the asbestos to public school children, it took her office about four months to send a memorandum to the Buildings Unit of the State Education Department authorizing the latter office to send out a letter to the Hartford School System (and other school systems so designated) asking Hartford what they had done to eliminate their asbestos problem in their schools. And even though this letter was received by the Hartford School System in April, 1978, (and referred to the Buildings and Grounds Department), Hartford in seven months has not replied to that letter.

The Hartford School System knows the health hazard posed by the asbestos at Quirk Middle School; the Hartford School System knows that the only solution is removal of the asbestos; why then does Hartford delay or oppose immediate removal? No one has ever told me that it was the cost, but then who would dare imply that money is more important than the lives of children. Even if it were conceivable that cost was a factor, one-half of the cost of removal of the asbestos would be paid for by the state. The longer the Hartford Board of Education delays removal, not only is there a greater danger posed by the asbestos, but inflation will drive up the portion of the cost that the Hartford School System will have to pay.

For any further information, or if you have any question about this material, please feel free to call me at room 308. My free period is the third period (10:50-11:50).

Telephone: 247-9211
Extension: 308

1

OFFICE
[illegible] COURT ST. [illegible]
WEST HAVEN, CONN. 06516

H. E. MURDOCK & SONS, INC.
GENERAL CONTRACTORS
P. O. BOX 43
WEST HAVEN, CONNECTICUT 06516

Inv. #267

Copy to
G. Donnelly
W. Calcagni

February 8, 1977

Hartford Board of Education
249 High Street
Hartford, Connecticut

Attn: Walter Read

ASBESTOS ANALYSIS

Fox Middle-low percentage of Chrysotile fibers. Product may be Monocoat Zonalite MK3. Percentage of asbestos appears to be less than 5%	25.00	
Waverly-Chrysotile asbestos and rock wool mixture. Percentage of asbestos 10%	25.00	
Laurel-Chrysotile asbestos 10% of sample	25.00	
HPHS-Chrysotile asbestos, approx. 10%	25.00	
Wish-Contains Chrysotile asbestos. Percentage approx. 20% of sample	25.00	
J.C. Clark-Contains Chrysotile asbestos. Percentage approx. 10%	25.00	
Hooker-Appears to be ornamental ground cementitous material. Unable to find any mineral fibers. Negative for asbestos	25.00	
✓ Quirk-Chrysotile asbestos approx. 15% of sample. Material extremely friable and fiber dissemination highly probable	25.00	Not
Total Amount Due		$200.00

For further medical and technical details, please call Dr. Robert Sawyer, 432-4237

If you are interested in an estimate for removal, please call this office.

Hartford Board of Education - Thomas J. Quirk School September 8, 197

Conditions: Barometric Range:
8/16 30.20 - 30.08 mm Hg
8/17 29.76 - 29.67 mm Hg
8/18 29.93 - 29.88 mm Hg
8/19 30.05 mm Hg

Ambient Temperature:
8/16 74°F
8/17 74°F - 78°F
8/18 75°F - 77°F
8/19 72°F - 77°F

Flow Control Rate: 2.0 Liters per min.

Sample No.	Date of Collection	Time of Collection	Collection Area	Total Particles Count - Less than 5 microns	Total Particle Count - Greater than 5 microns	*Particle Count Greater than 5 microns per cubic centimeter
1 (#4)	8/16/77	1:20-3:30	1st Floor "B"	2497	1764	0.007
2	8/17/77	8:30-9:30	3rd Floor "B"	918	1094	0.005
3	8/17/77	9:30-11:30	3rd Floor "B"	1958	358	0.004
4	8/17/77	11:45-1:45	1st Floor "A"	3784	1200	0.005
5	8/17/77	1:45-3:15	1st Floor "A"	782	646	0.003
6	8/18/77	7:25-9:25	Ground "B"	4609	3726	0.016
7	8/18/77	9:25-11:25	Ground "B"	5571	3442	0.014
8	8/19/77	7:10-9:10	2nd Floor "B"	2336	1174	0.005
9	8/19/77	9:10-11:10	2nd Floor "B"	3922	2572	0.011
10	8/19/77	11:30-1:30	1st Floor "B"	1092	374	0.002

*Note: Permissible exposuro 2.0 fibers per cubic centimeter
Greater than 5 micrometers.

Hartford Courant 9/12/78

Study Ties 20% of All Cancer to Jobs

WASHINGTON (AP) — A new scientific study indicates at least 20 percent of all cancer in the United States may be work related, Health, Education and Welfare Secretary Joseph A. Califano Jr. said Monday.

That is much higher than the previous estimates of only 1 percent to 5 percent, the head of HEW told an AFL-CIO conference on occupational safety and health.

Califano said the new study by scientists at the National Cancer Institute and the National Institute of Environmental Health Sciences concludes:

"If the full consequences of occupational exposures in the present and the recent past are taken into account, estimates of at least 20 percent appear much more reasonable and may even be conservative."

Califano said, "this means that at least 20 percent of all cancer in the United States, and perhaps more, may be work-related."

He said the full study would be released later this week.

A five page summary of the study said asbestos was to blame for the largest number of cancers incurred on the job.

It said that up to 11 million workers were exposed to asbestos, including 4.5 million who worked in shipyards during World War II.

Califano said, "an estimated five million American men and women — workers in asbestos plants, insulation workers, construction workers, steamfitters, carpenters, tile setters, auto mechanics and the like — breathe significant amounts of asbestos fibers each day."

He said asbestos may figure in 10 percent to 15 percent of all cancer deaths in the United States each year.

The study's summary said 1.6 million of four million heavily-exposed workers are expected to die of asbestos-related cancers. That's 67,000 a year for the next 30 to 35 years.

"Such numbers would represent about 17 percent of all cancers detected annually in the United States," the study said.

It also cited these figures for less well known cancer risks in the workplace.

—Arsenic: About 1.5 million workers potentially exposed, they run a 3 times to 8 times greater risk of lun-

See 20%, Page 6

Hartford Courant Classified Ad Dept. open Wednesday and Thursday evenings, 5 to 8. Telephone service only 249-6492.—Advt.

20% of Cancer Related to Work

Continued from Page 1

cancer. An estimated 2,100 to 7,300 excess cancers will be caused each year.

—Benzene: Two million workers potentially exposed, with the risk ratio 2 times to 7 times greater for leukemia. It will caused an estimated 240 to 1,400 excess cancers per year.

—Coal Tar Pitch and Coke Oven Emissions: About 60,000 workers potentially exposed, to risks 2-6 times greater than normal for cancer of the lung, larynx, skin and scrotum. Excess cancers estimated at 160 to 800 per year.

—Vinyl Chloride: 2.3 million workers potentially exposed, with risks 200 times, 4 times, and 1.9 times higher respectively for hemangiosarcoma, brain and lung cancer. Excess cancers estimated at 1,940.

The study said one to three percent of the cancers occurring in a year will be associated with these four substances.

It also cited possible excess cancers caused by chromium, iron oxide, nickel and petroleum distillates, but said it was less certain how many workers had been exposed. These four substances could account for 3 percent to 18 percent of the cancers occurring in a year, the study said.

"Thus the total excess (cancer) incidents would be from 21 (percent) to 38 percent. We choose to use the figure 20 percent in order to be conservative," it said.

The Herald
6/27/1978

Tell of cancer danger

Asbestos-ceiling hazard in schools cited at parley

By PATRICIA McCORMACK
UPI Health Editor

NEW YORK(UPI) — Exposure to asbestos dust can give you cancer 20 or so years later, it was reported Monday at a New York Academy of Science conference on environmental hazards.

There is no question about that, Dr. Robert Sawyer, Yale University Medical School Professor of Preventive and Occupational Medicine, told the meeting.

"I'm talking about facts backed up by dead bodies," he said at a workshop on the problem of safely removing and destroying asbestos where it is hazardous.

Sawyer directed removal of a flaking asbestos ceiling from the Yale Art and Architecture Library four years ago. His technician, Edward Swoszowski, said workmen were covered from head to toe and wore respirators.

The noxious material was removed, sealed in plastic bags, and buried in a "not to be disturbed" place approved by the Environmental Protection Agency.

Ripping off the asbestos, sawing at it, carting it through town to the trash bin will just make the asbestos hazard worse in America, conferees were told.

"The most frightening thing that could happen," Sawyer said, "would be if everyone panics and tries to remove asbestos hazards themselves."

To the do-it-yourselfer, there was this caution: Do not try to scrape off anything, including old texurixed paint suspected of containing asbestos.

It's a job for specialists and there are only a handful."

One of the immediate problems is to train such specialists and license or certify them, the hazard-hunting scientist reported.

It was suggested that Congress set up the machinery to safely solve the nation's asbestos dilemma reaching into many homes, schools, hospitals, factories.

Asbestos used in schools built from the 1940s through 1973 — when the EPA banned it — could cause cancer two decades from now in susceptible children who inhale or swallow the tiny fibers.

The asbestos dust, buoyant enough to float in still air, can only be seen through an electron microscope.

Kenneth Z. Silver, reported a nationwide survey on asbestos in schools, conducted by the Massachusetts Public Action Research Group.

"Congressional hearings should be held ... to bring the asbestos issue in schools to wider attention."

Silver said half the states didn't respond to the survey started in February of 1977 — shortly after an asbestos problem in a Howell Township, N. J., school raised questions about dangers to teachers, students and staff in all schools.

In New Jersey, 45 schools were found with flaking asbestos ceilings. A probe found 167 Massachusetts schools with the sprayed-on ceilings.

Connecticut has tagged 26 schools with asbestos hazards and is clearing them of the danger.

Asbestos also was sprayed on other buildings as fireproofing, insulating and acoustical material from the 1940s on. It is in wall panels used in some home construction, especially in Puerto Rico.

Sawyer, in a "Hazard Abatement" guide put out for the EPA, reports asbestos can be found in materials used for some roofing, flooring, fireproofing; as reinforcing material in certain cements, as coating material for thermal and acoustical insulation.

It is no longer used in texturizing paint. But you might find some in modeling clay — and even baby powder, according to Sawyer's technician, Swoszowski.

ASBESTOS PROBLEM AT QUIRK MIDDLE SCHOOL

TO: THE HARTFORD BOARD OF EDUCATION
on January 9, 1979

SUBMITTED BY: Geoffrey G. Mandly
100 Price Blvd.
West Hartford, Connecticut
06119

ASBESTOS

When Quirk Middle School in Hartford was built in 1972 a sprayed on asbestos fireproofing was used throughout the school. Because of the type of asbestos used and the nature of the air handling system at Quirk, asbestos fibers are being pushed every day through the fresh air vents into virtually all classrooms and halls in the school.

Two years ago the Hartford Board of Education received a consultant's report indicating (1)that there was asbestos laden fireproofing at Quirk, (2)that this asbestos fireproofing was extremely unstable,and(3)that dissemination of asbestos fibers was highly probable. Yet in the two years since that consultant's report Hartford has done very little to monitor the asbestos problem in the Hartford public schools,and it has done absolutely nothing to eliminate the health hazard posed by the asbestos at Quirk Middle School.

If we can assume that the information contained in the consultant's report is valid,then the State Health Department and the School Buildings Unit of the State Board of Education recommend either encapsulation or removal of the asbestos at Quirk. This recommendation is based on criteria which the State Health Department developed for determining the health hazard posed by asbestos in the public schools. But the Hartford Board of Education has rejected this criteria and,instead,has adopted a less strict OSHA or occupational standard. Such an occupational health standard has no meaningful application to a student population. Unlike a worker who can decide whether or not to accept the health risk associated with his working environment,a child,especially one who is economically disadvantag has little or no choice where he goes to school.

There is no question that inhaling asbestos fibers can cause debilitating and fatal lung diseases in humans. And every day the children and staff at Quirk Middle School are being subjected to asbestos fallout in their classrooms. The danger posed by the asbestos should be removed, and Hartford's failure to do so evades its responsibility to provide a safe and healthy environment in its public schools.

My recommendations are as follows:

1. Immediate installation if feasible of submicron filters in the air handling units to decrease the amount of asbestos fallout.
2. Conduct an extensive test of airborne asbestos fibers at Quirk Middle School during the first week after school has let out for the 1979 summer vacation.
3. After completion of the airborne asbestos tests but not more than ten days after the last school day before the 1979 summer vacation,the commencement of either encapsulation or removal of the asbestos by a contractor with expertise in such large scale asbestos removal.
4. Conduct a test of airborne asbestos fibers at Quirk Middle School after removal or encapsulation of the asbestos.
5. Publication of the results of both airborne asbestos tests.

The above recommendations would serve several purposes;(a)there would not be a disruption of the school year,(b)there would be sufficient time for a thorough completion of either removal or encapsulation of the asbestos as well as a sufficient amount of time to analyze and compare the post removal airborne tests with those tests conducted prior to the asbestos removal,and(c)there would be an assurance that the children,parents, community,and staff at Quirk would not be exposed to a greater asbestos risk after the removal of the asbestos than before removal.

I am submitting my asbestos report along with the following questions:

1. Do you intend to read and have you read my asbestos report? If not,why not
2. What steps will the Board of Education take to eliminate the health hazard posed by the presence of asbestos at Quirk Middle School.
3. Should any of my recommendations be adopted? If Yes,which ones or all? If No,which ones do you disagree with and the reason for the rejection of such recommendation(s).

OVERSIGHT HEARINGS ON ASBESTOS HEALTH HAZARDS TO SCHOOLCHILDREN

THURSDAY, FEBRUARY 22, 1979

House of Representatives,
Subcommittee on Elementary, Secondary,
and Vocational Education,
Committee on Education and Labor,
Washington, D.C.

The subcommittee met at 9:40 a.m., in room 2175, Rayburn House Office Building, Hon. Carl D. Perkins (chairman) presiding.

Members present: Representatives Perkins, Miller, Kildee, Kogovsek, Buchanan, Erdahl, and Hinson.

Staff present: John F. Jennings, counsel; William C. Clohan, minority assistant education counsel; Nancy L. Kober, staff assistant; and Jane Charbonneau, staff intern.

Mr. **Kogovsek** [presiding]. Good morning. The committee will come to order.

I would first of all like to apologize for Chairman Perkins—because of the weather he is tied up; he will be here shortly; he is delayed at least for half an hour. I would on his behalf like to read his opening statement, and then we will proceed with the testimony.

The Subcommittee on Elementary, Secondary, and Vocational Education is conducting a hearing today on H.R. 1435 and H.R. 1524. These two bills, the first of which Chairman Perkins introduced and the second of which Congressman Miller introduced, would provide aid to States and local school districts to help them detect and remove or treat hazardous asbestos materials in their buildings.

Earlier this year the subcommittee heard testimony regarding the harmful effects to the health of students, teachers, and school employees that may occur through exposure to asbestos. I was particularly disturbed by testimony from medical experts that there is no known safe level of asbestos exposure and that the substance can lead to a rare, incurable form of cancer. And while estimates of the number of schools in the country which contain asbestos run from 5 to 16 percent, there has been no national survey or uniform detection program that would enable us to pinpoint the extent of the problem more accurately.

These findings from our hearings led me to conclude that it is essential for the Federal Government to become involved at this time. Unfortunately, many school districts that do have an asbestos problem simply do not have the funds to pay for a removal program. In addition, there is a lack of information and of standards

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for quality control to help districts to make decisions about how dangerous the material may be; how it should be treated, and who should do the removal work.

I would like to commend Congressman Miller for his leadership in this area. I might add that we expect to mark up legislation very soon, using Mr. Miller's bill as a basis. I am sure that the comments of the witnesses today on the specific points of these two bills will be most helpful to us in the process.

[The complete text of H.R. 1435 and H.R. 1524 follow:]

96TH CONGRESS
1ST SESSION

H. R. 1435

To establish a program for the inspection of schools for the presence of asbestos materials, to provide funds for the testing and evaluation of potential hazards, to create a loan program to assist in the containment or removal of imminent hazards to health and safety, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

JANUARY 24, 1979

Mr. PERKINS introduced the following bill; which was referred to the Committee on Education and Labor

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A BILL

To establish a program for the inspection of schools for the presence of asbestos materials, to provide funds for the testing and evaluation of potential hazards, to create a loan program to assist in the containment or removal of imminent hazards to health and safety, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SHORT TITLE

SECTION 1. This Act may be cited as the "Asbestos School Hazard Detection and Control Act of 1979".

FINDINGS AND PURPOSES

SEC. 2. (a) The Congress finds that—

(1) exposure to asbestos and materials containing asbestos has been identified over a long period of time and by reputable medical and scientific evidence as significantly increasing the incidence of cancer and other severe or fatal diseases, such as asbestosis;

(2) medical evidence has suggested that children may be particularly susceptible to environmentally induced cancers;

(3) medical science has not established any safe level of exposure to asbestos as a threshold above which the likelihood of developing illness occurs;

(4) substantial amounts of asbestos, particularly in sprayed form, were used in school buildings, especially during the period 1946–1972;

(5) partial surveys in some States have indicated that there exists in a number of schools asbestos materials which have become damaged or friable, from which asbestos is being or may be dislodged into the air;

(6) asbestos concentrations far exceeding the normal ambient air levels have been found in schools with damaged asbestos;

(7) the Department of Health, Education, and Welfare and the Environmental Protection Agency, as well as several States, have attempted to publicize the potential hazards to school children and employees from asbestos, but there does not exist any systematic or mandatory program for identifying hazardous conditions in schools, or for remedying them;

(8) there exists no health standard regulating the concentration of asbestos in the nonworking environment, such as a school;

(9) custodial workers, teachers, and other school employees may be exposed to hazardous concentrations of asbestos in school buildings; and

(10) without an improved program of information distribution, technical and scientific assistance, and financial support, many school districts and States will not be able to mitigate the potential asbestos hazards where they occur in their schools.

(b) It is the purpose of this Act to—

(1) direct the Secretary of Health, Education, and Welfare, in conjunction with other appropriate officials, to establish a task force to direct Federal efforts to ascertain the extent of the danger to the health of school children and employees from asbestos materials in the schools;

(2) require States to prepare a plan which establishes a program for the systematic inspection of all school buildings in order to identify the presence of asbestos or asbestos materials in hazardous conditions;

(3) provide scientific and technical assistance to the States and local school boards in conducting the survey, related tests and evaluations;

(4) provide loans for the mitigation of serious asbestos hazards which constitute an imminent danger to the health and safety of school children and employees;

(5) assure that no employee of any school district, State or local government, or Federal agency, suffers any disciplinary action as a result of calling attention to potential asbestos hazards which may exist in schools.

TASK FORCE

Sec. 3. (a) Within thirty days after the enactment of this section, the Secretary shall designate the members of an Asbestos Hazards School Safety Task Force (hereinafter referred to as "Task Force"). The Task Force shall be composed of persons with knowledge of the scientific and medical problems associated with exposure to asbestos, and of persons with knowledge of procedures and programs for the containment or removal of asbestos from buildings. Membership on the Task Force shall include a representative of the Office of Education, the National Cancer Institute, the Environmental Protection Agency, the National Institute of Environmental Health Sciences, the Occupational Safety and Health Administration, and representatives of the public organizations concerned with education and health. In selecting membership from other Federal agencies or departments, the Secretary shall accept the persons nominated by the Secretary or Administrator of that Department or Agency. The Secretary shall designate a chairman of the Task Force.

(b) Members of the Task Force who are not full-time employees of the Federal Government shall be reimbursed for actual expenses incurred in conjunction with their service on the Task Force, and shall receive a per diem compensation at a rate not to exceed the maximum rate prescribed for grade GS-16.

(c) The Task Force shall convene, no later than thirty days after the appointment of its members, at the call of the chairman.

(d) The duties of the Task Force shall include—

(1) the preparation of educational materials for distribution to the States and local school boards in conjunction with the plan required in section 4 of this Act;

(2) the compilation and dissemination of medical, scientific, technological, and other materials, reports,

instructions, and information to State and local governments and to local school boards explaining the health and safety hazards associated with asbestos materials, the means of identifying, sampling, and testing materials suspected of containing asbestos;

(3) the review and approval of State plans and applications for reimbursements and loans pursuant to sections 5 and 6 of this Act;

(4) the establishment of criteria concerning the levels of hazards posed by asbestos in advanced stages of disrepair which may constitute an imminent danger to the health and safety of school children and employees, for the purpose of determining eligibility for loans pursuant to section 6 of this Act;

(5) making recommendations to the Secretary on the awarding of grants for technical assistance pursuant to section 5(c) of this Act.

STATE PLAN

SEC. 4. (a) No later than September 1, 1979, each State which desires to enable its schools to participate in programs under this Act shall submit to the Secretary a plan for the notification of administrators of all schools within that State's jurisdiction of the health hazards associated with exposure to asbestos, and recommended methods for the safe, orderly, and expeditious containment or removal, as deemed necessary by competent scientific or medical individuals, of asbestos materials which pose an imminent hazard to the health and safety of persons utilizing such school buildings. Such plan shall include—

(1) a timetable for the identification, not later than January 1, 1980, of imminent asbestos health hazards in all schools situated within such State;

(2) a description of the procedures which are to be utilized in locating and identifying such hazards, in accordance with safety rules promulgated by the Secretary in accordance with section 7 of this Act;

(3) a timetable for the expeditious containment or removal of asbestos hazards which have been identified pursuant to paragraph (1) of this subsection no later than September 1, 1980, unless an extension has been granted by the Secretary due to extraordinary circumstances;

(4) procedures for maintaining records on the presence of asbestos materials in schools and future containment or removal activities; and

(5) the identification of a State agency or other administrative unit with the responsibility for the preparation of the plan and the administration of the control program which it describes.

(b) The Secretary shall approve a plan which meets the requirements of subsection (a) of this section, provided that it has been reviewed and approved by the Task Force. The Secretary may not approve any plan which has been rejected by the Task Force.

ASBESTOS HAZARDS DETECTION

SEC. 5. (a)(1) Units of local government with the responsibility for the administration and safety of schools may apply to the Secretary for a reimbursement from funds available for purposes of this section for up to one-half of the costs of surveying and testing school buildings in order to determine whether hazardous concentrations of asbestos or asbestos products exist in schools of that jurisdiction. Such application shall contain, in addition to supplemental information which the Secretary may require—

(A) a description of the proposed survey, including testing techniques;

(B) an estimate of the total cost of the survey;

(C) the identification of any party which may be engaged to conduct the testing, including a description of the party's professional expertise for such testing.

Any testing facility selected under clause (C) shall meet competency standards established by the Secretary.

(2) The Secretary shall designate, in conjunction with the Task Force, those costs which are reimbursable under paragraph (1) of this subsection. Such costs shall include—

(A) administrative costs of preparing and supervising the survey;

(B) costs of conducting visual inspections of school buildings;

(C) sampling of building and insulation materials;

(D) appropriate tests to determine the level of asbestos content in suspected materials; and

(E) air sampling and testing, if deemed essential to determining the likelihood of imminent danger.

(b)(1) The Secretary shall make payments from funds available under this Act for purposes of this section for a period of three years following the date of enactment of this Act.

(2) The one-half cost restriction contained in subsection (a)(1) may be waived upon a determination by the Secretary that the fiscal resources of the locality are limited to the extent that imposition of such restriction would prevent participation in the program.

(c) The Secretary may allocate up to 20 per centum of the funds available for purposes of this section for use in education and technical assistance programs.

(d) Recipients of grants under this section shall file a report with the Secretary no later than one hundred and twenty days after receipt of the grant describing the detection and testing activities which were undertaken, the results, and the plan for mitigating any imminent hazards which had been detected. The report shall include a detailed accounting of funds received from all sources, and funds expended.

ASBESTOS HAZARDS CONTROL LOAN PROGRAM

SEC. 6. (a) There is hereby created an Asbestos Hazards Control Loan Program in the Department of Health, Education, and Welfare (hereinafter referred to as the Loan Program). The Loan Program shall be administered by the Secretary or his designee.

(b) Loans from the Loan Program shall be available only for the mitigation or removal of asbestos or asbestos materials which pose an imminent hazard to the health and safety of children or employees and which is situated in school buildings. Loans shall be limited to projects covering more than 2,500 square feet, in which the asbestos material is at a level specified by the Secretary.

(c)(1) Loans under this section shall be for a period not to exceed twenty years, shall be interest free, shall be used to provide not more than one-half the cost of the asbestos containment or removal, and shall be subject to terms and conditions established by the Secretary.

(2) The one-half cost restriction contained in paragraph (1) may be waived upon a determination by the Secretary that the fiscal resources of the locality are limited to the extent that imposition of such restriction would prevent participation in the program.

(d) Applicants for loans from the Loan Program shall submit an application which describes—

(1) the nature of the asbestos problem;

(2) the results of preliminary testing (conducted in accordance with professional scientific standards established by the Secretary, in consultation with the Task Force) which indicates the asbestos content of the affected material;

(3) the methods which will be used to contain or remove the asbestos materials, in accordance with section 7 of this Act.

(e) The Secretary shall establish a prevailing rate for containment or removal work performed with loan funds provided under this section, determined on the basis of prevailing wage rates in the location of such work.

(f) The Secretary is authorized to establish additional requirements or procedures which shall govern the loan application or award process.

(g) The Secretary shall make an annual report to the appropriate committees of the House of Representatives and the Senate which shall describe—

(1) the number of loans and the location of each applicant which have been made in the preceding year;

(2) the nature of the asbestos problem of each applicant;

(3) the type of containment or removal program which was undertaken;

(4) the estimated cost, and the actual cost of mitigation efforts;

(5) the number and description of applications which have been rejected.

SAFETY PROCEDURES

SEC. 7. (a) Within one hundred and twenty days after enactment of this section, the Secretary shall promulgate and distribute to the States safety standards and procedures for testing the level of asbestos in schools and for determining the likelihood of the leakage of asbestos into the school environment.

(b) All sealing, containment, or removal of asbestos materials pursuant to this Act, or future construction, modification, or demolition of schools which contain asbestos materials, shall be conducted in strict accordance with regulations and procedures established by the Occupational Safety and

Health Administration or procedures established by the Task Force. Any employee engaged in such activity must be notified in writing of the hazards of working with asbestos, and must utilize all safety procedures to minimize risk to his or her health.

(c) No child or school employee shall be permitted in the vicinity of any asbestos containment or removal activity, unless school authorities certify that there is no risk of exposure to the students or personnel.

NONDISCRIMINATION

SEC. 8. No employer who receives funds under this Act shall discharge or in any other way discriminate against or discipline any worker employed by him or her by reasons of the fact that such worker focuses public attention on the asbestos problem in his or her school district.

RETAINED RIGHTS

SEC. 9. Nothing in this Act shall in any way restrict the rights of any individual or group of individuals, or any public agency or government, to seek any legal redress in connection with the purchase or installation of asbestos materials in schools, or with regard to any claim of disability or death in connection with exposure to asbestos in a school setting. Nor shall this Act affect any litigation or petitions for administrative action under any statute existing prior to the enactment of this section. In the event that an action under section 6 of the Toxic Substances Control Act of 1976 is successful and the obligation for mitigation and safety actions is deemed to be the total responsibility of the manufacturers, the Secretary is authorized and directed to seek to recover from such manufacturers any Federal funds, including administrative costs, expended for programs required by this Act.

DEFINITIONS

SEC. 10. As used in this Act, the term—

(1) "Secretary" means the Secretary of Health, Education, and Welfare, or his designee;

(2) "schools" means any building, structure, or facility which is primarily used as a school for children, either public or private;

(3) "asbestos or asbestos material" means any building materials, sprayed materials, insulation, or other substance which is composed entirely or in part of chrysotile, amosite, or crocidolite, and when they occur in fibrous habit, tremolite, anthophyllite, and actinolite;

(4) "imminent hazard to the health and safety" means, in regard to section 6, that the asbestos or asbestos material is, according to standards established by the Task Force and approved by the Secretary, friable or easily damaged, or within easy reach of students or otherwise susceptible to damage which could

result in the dispersal of asbestos fibers into the school environment (including damage from water or air circulation);

(5) "State" means each of the several States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the Virgin Islands, the Commonwealth of the Northern Marianas, and the Trust Territory of the Pacific Islands.

AUTHORIZATIONS

SEC. 11. There are authorized to be appropriated for fiscal year 1980 and for each of the succeeding fiscal years for the purposes and programs established by this Act, such sums as are necessary.

96TH CONGRESS
1ST SESSION

H. R. 1524

To establish a program for the inspection of schools for the presence of hazardous asbestos materials, to create a fund for the testing and evaluation of potential hazards, to create a loan program to assist in the containment or removal of imminent hazards to health and safety, and for other purposes.

IN THE HOUSE OF REPRESENTATIVES

JANUARY 25, 1979

Mr. MILLER of California (for himself, Mr. WEISS, Mr. THOMPSON, Mr. CORRADA, Mr. MAGUIRE, Mr. PHILIP BURTON, Mr. SIMON, and Mr. RICHMOND) introduced the following bill; which was referred to the Committee on Education and Labor

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A BILL

To establish a program for the inspection of schools for the presence of hazardous asbestos materials, to create a fund for the testing and evaluation of potential hazards, to create a loan program to assist in the containment or removal of imminent hazards to health and safety, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. This Act may be cited as the "Asbestos School Hazard Detection and Control Act of 1979".

SEC. 2. (a) FINDINGS.—The Congress finds that—

(1) exposure to asbestos and materials containing asbestos has been identified over a long period of time and by reputable medical and scientific evidence as significantly increasing the incidence of cancer and other severe or fatal diseases, such as asbestosis;

(2) medical evidence has suggested that children may be particularly susceptible to environmentally induced cancers;

(3) medical science has not established any safe level of exposure to asbestos as a threshold above which the likelihood of developing illness occurs;

(4) substantial amounts of asbestos, particularly in sprayed form, were used in school buildings, especially during the period 1946–1972;

(5) partial surveys in some States have indicated that there exists in a number of schools asbestos materials which have become damaged or friable, from which asbestos is being or may be dislodged into the air;

(6) asbestos concentrations far exceeding the normal ambient air levels have been found in schools with damaged asbestos;

(7) the Department of Health, Education, and Welfare and the Environmental Protection Agency, as

well as several States, have attempted to publicize the potential hazards to schoolchildren and employees from asbestos, but there does not exist any systematic or mandatory program for identifying hazardous conditions in schools, or for remedying them;

(8) there exists no health standard regulating the concentration of asbestos in the nonworking environment, such as a school;

(9) custodial workers, teachers, and other school employees may be exposed to hazardous concentrations of asbestos in school buildings;

(10) without an improved program of information distribution, technical and scientific assistance, and financial support, many school districts and States will not be able to mitigate the potential asbestos hazards where they occur in their schools.

(b) PURPOSES.—It is the purpose of this Act to—

(1) mandate the Secretary of Health, Education, and Welfare, in conjunction with other appropriate officials, to establish a task force to direct Federal efforts to ascertain the extent of the danger to the health of schoolchildren and employees from asbestos materials in the schools;

(2) require States to prepare a plan which establishes a program for the systematic inspection of all

school buildings in order to identify the presence of asbestos or asbestos materials in hazardous conditions;

(3) provide scientific and technical assistance to the States and local school boards in conducting the survey, related tests, and evaluations;

(4) establish an Asbestos Hazards Detection Fund from contributions provided by manufacturers of asbestos, from which will be provided the nonlocal share of moneys for inspection, sampling, and testing programs;

(5) provide loans for the mitigation of serious asbestos hazards which constitute an imminent danger to the health and safety of schoolchildren and employees;

(6) assure that no employee of any school district, State or local government, or Federal agency, suffers any disciplinary action as a result of calling attention to potential asbestos hazards which may exist in schools.

TASK FORCE

SEC. 3. (a) Within thirty days after the enactment of this section, the Secretary shall designate the members of an Asbestos Hazards School Safety Task Force (hereinafter referred to as "Task Force"). The Task Force shall be composed of persons knowledgeable of the scientific and medical problems associated with exposure to asbestos, and of persons knowledgeable of procedures and programs for the containment or removal of asbestos from buildings. Membership on the Task Force shall be composed of, but not limited to, a representative of the United States Office of Education, the National Cancer Institute, the Environmental Protection Agency, the National Institute of Environmental Health Sciences, the Occupational Safety and Health Administration, and representatives of the public organizations concerned with education and health. In selecting membership from other Federal agencies or departments, the Secretary shall accept the persons nominated by the Secretary or Administrator of that department or agency. The Secretary shall designate a Chairman of the Task Force.

(b) Non-Federal members of the Task Force shall be reimbursed for actual expenses incurred in conjunction with their service on the Task Force, and shall receive a per diem compensation at a rate not to exceed that of a GS-16.

(c) The Task Force shall convene no later than thirty days after the appointment of its members, at the call of the Chairman.

(d) The duties of the Task Force shall include—

(1) the preparation of educational materials for distribution to the States and local school boards in conjunction with the plan required in section 4 of this Act;

(2) the compilation and dissemination of medical, scientific, technological, and other materials, reports, instructions, and information to State and local governments and to local school boards explaining the health and safety hazards associated with asbestos materials, the means of identifying, sampling, and testing materials suspected of containing asbestos;

(3) the review and approval of State plans and applications for reimbursements and loans pursuant to sections 5 and 6 of this Act;

(4) the establishment of criteria concerning the levels of hazards posed by asbestos in advanced stages of disrepair which may constitute an imminent danger to the health and safety of schoolchildren and employees, upon which will be based eligibility for loans pursuant to section 6 of this Act;

(5) making recommendations to the Secretary on the awarding of grants for technical assistance pursuant to section 5 of this Act.

STATE PLAN

SEC. 4. (a) No later than September 1, 1979, each State shall submit to the Secretary a plan for the notification of administrators of all schools within that State's jurisdiction of the health hazards associated with exposure to asbestos, and recommended methods for the safe, orderly, and expeditious containment or removal, as deemed necessary by competent scientific or medical individuals, of asbestos materials which pose an imminent hazard to the health and safety of persons utilizing such school buildings. Such plan shall include—

(1) a timetable for the identification of imminent asbestos health hazards in all schools situated within such States: *Provided,* That the procedure for identifying such hazards shall be completed no later than January 1, 1980;

(2) a description of the procedures which shall be utilized in locating and identifying such hazards, in accordance with safety rules promulgated by the Secretary in accordance with section 7 of this Act;

(3) a timetable for the expeditious containment or removal of asbestos hazards which have been identified pursuant to subsection (1) of this section and in accordance with regulations promulgated by the section: *Provided,* That such removal shall be completed no later than September 1, 1980, unless an extension has been granted by the Secretary due to extraordinary circumstances;

(4) procedures for maintaining records on the presence of asbestos materials in schools and future containment or removal activities;

(5) the identification of a State agency or other administrative unit with the responsibility for the preparation of the plan and the administration of the control program which it describes.

(b) The Secretary shall approve a plan which meets the requirements of subsection (a) of this section: *Provided*, That it has been reviewed and approved by the Task Force. The Secretary may not approve any plan which has been rejected by the Task Force.

ASBESTOS HAZARDS DETECTION FUND

SEC. 5. (a) There is hereby created an Asbestos Hazards Detection Fund (hereinafter referred to as the "fund") in the Department of Health, Education, and Welfare. The fund shall be administered by the Secretary, or by his designee. All moneys accruing to the fund shall be deposited in the Treasury of the United States, together with all interest accruing thereon. Withdrawals from the fund shall be made only by the Secretary for purposes authorized under this Act.

(b) PAYMENTS INTO THE FUND.—(1) Any company which was engaged in the mining, manufacture, or importation of asbestos between the years 1946 and 1972 shall make payments into the fund. The total of contributions to the fund shall not exceed $30,000,000. Each company's financial obligation to the fund shall be a percentage equivalent to its proportion of asbestos mining, manufacture, or importation during the period 1946–1972 (adjusted to 1979 value). Each company shall pay into the fund no less than one-third of its total obligation in each of the three years subsequent to the enactment of this Act.

(2) Each manufacturer of asbestos products shall make available to the Secretary an audit with an accurate accounting of (i) the amount of asbestos products it produced in the period 1946–1972; (ii) a description of the products and their use; and (iii) other pertinent data as the Secretary may require.

(3) The Secretary and the Attorney General of the United States are authorized and directed to subpena the records described in subsection (2) of this section, together with any and all supplemental data which either may deem necessary to assure than an accurate payment is made by each company into the fund. All information received by the Secretary under this Act from an asbestos manufacturer shall remain confidential with the Secretary.

(c) PAYMENTS FROM THE FUND.—(1) Units of local government with the responsibility for the administration and safety of schools may apply to the Secretary for a reimbursement from the fund for up to half of the costs of surveying and testing school buildings in order to determine whether hazardous concentrations of asbestos or asbestos products exist in schools of that jurisdiction. Such application shall contain, in addition to supplemental information which the Secretary may require—

(i) a description of the proposed survey, including testing techniques;

(ii) an estimate of the total cost of the survey;

(iii) the identification of any party which may be engaged to conduct the testing, including a description of the party's professional expertise for such testing: *Provided*, That any testing facility shall meet competency standards established by the Secretary.

(2) The Secretary shall designate, in conjunction with the Task Force, those costs which are reimbursable under subsection (1) of this section. Such costs shall include—

(i) administrative costs of preparing and supervising the survey;

(ii) costs of conducting visual inspections of school buildings;

(iii) sampling of building and insulation materials;

(iv) appropriate tests to determine the level of asbestos content in suspected materials; and

(v) air sampling and testing, if deemed essential to determining the likelihood of imminent danger.

(3) The Secretary shall make reimbursements from the fund for a period of three years following the date of enact-

ment. Moneys remaining in the fund at that time shall be returned, on a proportional basis, to the contributing asbestos manufacturers.

(4) Subject to the approval of the Secretary, a contributor may provide asbestos testing and analysis services for school districts or other entities which require such testing, in lieu of a portion of its contribution, not to exceed 50 per centum of such contribution. Rates for such analysis and testing shall be established by the Secretary at a rate equal to the prevailing fee for such services.

(5) The Secretary may allocate up to 20 per centum of the moneys from the fund for use in the education and technical assistance programs authorized by this Act.

(6) Recipients of grants under this section shall file a report with the Secretary no later than one hundred and twenty days after receipt of the grant describing the detection and testing activities which were undertaken, the results, and the plan for mitigating any imminent hazards which had been detected. The report shall include a detailed accounting of funds received from all sources, and funds expended.

ASBESTOS HAZARDS CONTROL LOAN PROGRAM

SEC. 6. (a) There is hereby created an Asbestos Hazards Control Loan Program in the Department of Health, Education, and Welfare (hereinafter referred to as the "loan program"). The loan program shall be administered by the Secretary or his designee.

(b) Loans from the loan program shall be available only for the mitigation or removal of asbestos or asbestos materials which pose an imminent hazard to the health and safety of children or employees and which is situated in school buildings. Loans shall be limited to projects covering more than two thousand and five hundred square feet, in which the asbestos material is at least   per centum asbestos.

(c) Loans under this section shall be for a period not to exceed twenty years, and shall be interest free, under terms and conditions established by the Secretary.

(d) Applicants for loans from the loan program shall submit an application which describes—

(1) the nature of the asbestos problem;

(2) the results of preliminary testing which indicates the asbestos content of the affected material: *Provided,* That such testing shall meet professional scientific standards established by the Secretary and the Task Force;

(3) the methods which will be used to contain or remove the asbestos materials, in accordance with section 7 of this Act.

(e) The Secretary shall establish a prevailing rate for containment or removal work performed with loan funds provided under this section. The Secretary shall not award a loan for an amount in excess of the prevailing wage in any location.

(f) The Secretary is authorized to establish additional requirements or procedures which shall govern the loan application or award process.

(g) The Secretary shall make an annual report to the appropriate committees of the House of Representatives and the Senate which shall describe—

(1) the number of loans and the location of each applicant which have been made in the preceding year;

(2) the nature of the asbestos problem of each applicant;

(3) the type of containment or removal program which was undertaken;

(4) the estimated cost, and the actual cost of mitigation efforts;

(5) the number and description of applications which have been rejected.

(h)(1) Upon the making of any loan from the loan program under this section, and to the extent such loan remains outstanding, the United States shall be subrogated to any legal rights to recover such amount or assert a claim against any person or organization relating to the subject matter of a loan made from the loan program. Any recipient of a loan from the loan program shall execute and deliver instruments and papers and take whatever steps are necessary to secure such rights in the United States in order to entitle the United States to the entry of a judgment by a court and payment under this Act. No loan shall be made unless and until such steps have been taken. Except as provided for herein, to the extent that the loan remains due and owing, any purported limitation on the right of the United States to act as assignee or to become subrogated to the rights of the recipient of a loan from the loan program shall be without any effect.

(2) If the United States recovers from any person or organization any amount by the exercise of rights subrogated or assigned in subsection (1), the recipient of the relevant loan shall be entitled to forgivenes of any loan amounts still due and owing, but only to the extent that such recovery exceeds the costs of obtaining recovery plus interest that would have been charged if the relevant loan had been made at prevailing commercial rates.

SAFETY PROCEDURES

SEC. 7. (a) Within one hundred and twenty days after enactment of this section, the Secretary shall promulgate and distribute to the States safety standards and procedures for testing the level of asbestos in schools and for determining the likelihood of the leakage of asbestos into the school environment.

(b) All sealing, containment, or removal of asbestos materials pursuant to this Act, or future construction, modification, or demolition of schools which contain asbestos materials, shall be conducted in strict accordance with regulations and procedures established by the Occupational Safety and Health Administration or procedures established by the Task Force. Any employee engaged in such activity must be notified in writing of the hazards of working with asbestos, and must utilize all safety procedures to minimize risk to his or her health.

(c) No child or school employee shall be permitted in the vicinity of any asbestos containment or removal activity, except if school authorities certify that there is no risk of exposure to the students or personnel.

NONDISCRIMINATION

SEC. 8. No employer shall discharge or in any other way discriminate against or discipline any worker employed by him or her by reasons of the fact that such worker focuses public attention on the asbestos problem in his or her school district.

RETAINED RIGHTS

SEC. 9. Nothing in this Act shall in any way restrict the rights of any individual or group of individuals, or any public agency or government, to seek legal redress under any State or Federal statute in connection with the purchase or installation of asbestos materials in schools, or with regard to any claim of disability or death in connection with exposure to asbestos in a school setting except as provided in section 6(h) of this Act. Nor shall this legislation affect any litigation or petitions for administrative action under any statute existing prior to the enactment of this section. In the event that an action under section 6 of the Toxic Substances Control Act of 1976 is successful and the obligation for mitigation and safety actions is deemed to be the total responsibility of the manufacturers, the Secretary is directed to seek to recover from such manufacturers any Federal funds, including administrative costs, expended for programs required by this Act.

DEFINITIONS

SEC. 10. As used in this Act, the term—

(a) "Secretary" means the Secretary of the Department of Health, Education, and Welfare, or this designee;

(b) "schools" means any building, structure, or facility which is primarily used as a school for children, either public or private;

(c) "asbestos or asbestos material" means any building materials, sprayed materials, insulation, or other substance which is composed entirely or in part of chrysotile, amosite, or crocidolite, and when they occur in fibrous habit, tremolite, anthophyllite, and actinolite;

(d) "imminent hazard to the health and safety" means, in regard to section 6, that the asbestos or asbestos material is, according to standards established by the Task Force and approved by the Secretary, friable or easily damaged, or within easy reach of students or otherwise susceptible to damage which could result in the dispersal of asbestos fibers into the school environment (including damage from water or air circulation);

(e) "State" means each of the several States, the District of Columbia, the Commonwealth of Puerto Rico, Guam, American Samoa, the Virgin Islands, the Commonwealth of the Northern Mariannas, and the Trust Territory of the Pacific Islands.

AUTHORIZATIONS

SEC. 11. There are authorized to be appropriated for the fiscal years 1980, 1981, and 1982, for the purposes and programs established in this Act, such sums as are necessary.

Mr. Kogovsek. At this time I would like to call on Mr. William E. Blakey from HEW, the Deputy Assistant Secretary for Legislation and Education.

Mr. Blakey, it is an honor to have you here. I apologize for the attendance this morning. I am sure it will pick up as you go along. We are in the process of trying to get everybody here through the snow and the slushy streets, and so on. But, if you would begin with your statement it would be very much appreciated by the committee.

[The statement of Mr. Blakey follows:]

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

STATEMENT

of

WILLIAM A. BLAKEY

DEPUTY ASSISTANT SECRETARY FOR LEGISLATION (EDUCATION)

before the

SUBCOMMITTEE ON ELEMENTARY, SECONDARY, AND VOCATIONAL EDUCATION

COMMITTEE ON EDUCATION AND LABOR

on

Asbestos in Schools

Thursday, February 22, 1979
9:30 a.m.

Mr. Chairman and Members of the Subcommittee, I am pleased to have this opportunity to appear before the Subcommittee to present our analysis of H.R. 1435 and H.R. 1524, your bill and Mr. Miller's bill, both dealing with the important matter of assessing and relieving the potential health risks which may result from the use of asbestos-containing material in school buildings.

Mr. Chairman, you, Mr. Miller and other distinguished Members of the Subcommittee are to be congratulated for recognizing the importance and the immediacy of the problem involved in identifying and removing the asbestos health hazard from our school environments.

In testimony which has been provided to the Subcommittee, including that given by Dr. David Rall of HEW's National Institute of Environmental Health Sciences on January 8, concern was clearly spelled out about the possible health hazards associated with low level exposure to asbestos fibers. As you know, Secretary Califano has expressed and demonstrated concern for children who attend schools which were constructed with asbestos-containing materials. The Department has:

o Provided financial support for research into the effect of low levels of asbestos exposure (including the Mount Sinai study) which examined the extent to which asbestos materials were present in New Jersey schools, sampled air concentrations in the vicinity of asbestos materials in these schools, and studied the effectiveness of various techniques to control the release of asbestos into the air.

- Advised the Governors of all 50 states of the potential health risk of even low levels of exposure to asbestos in the environment.

- Cooperated with the Environmental Protection Agency (EPA) in providing technical assistance and information to the states, and a limited assessment of the problem and how best to cope with it.

- Planned a demonstration project, by the National Cancer Institute, which will focus on three aspects of the problem: (1) the health education of students and school personnel, and the education of contractors and construction workers involved in the removal or sealing of asbestos materials; (2) the development of a management approach for organizing the removal or sealing of the asbestos material which can be applied to other school systems; and (3) the development of quality control of tests to measure asbestos fibers. In addition, the National Cancer Institute is considering development of a competitive program of demonstration projects focused on the school asbestos problem. They would plan to commit approximately $2,000,000 to this program.

While the Department of Health, Education, and Welfare has no general authority to assist local school districts with the repair or renovation of school buildings which have become health hazards, the Commissioner of Education has discretionary funding authority under Section 303 of the Special

Projects Act of the Education Amendments of 1978 (P.L. 95-561), which could be used to (1) carry out a demonstration and evaluation of means of removing or sealing asbestos in one or more of the Federally supported schools; (2) modify guidelines and regulations to reflect the potential hazard associated with use of asbestos in schools; (3) convene a meeting of the building trades and associated trade unions to alert them to this problem and to seek their help in identifying the true extent of the problem; and (4) develop guides and media materials for school boards and school and education related groups describing the problem and spelling out possible solutions.

As a policy matter, we believe these activities should be continued, or begun where no activity has been initiated, in an effort to enhance the Federal government's ability to assist state and local government's with their responsibility to identify and eliminate asbestos fibers in the classrooms and other public buildings across the Nation.

Both H.R. 1435 and H.R. 1524 establish a program within the Department of Health, Education, and Welfare to assist the states in identifying those schools which contain asbestos fibers. Both bills also create a loan program to assist in the containment and removal of this hazardous material.

General Comments

The Department of Health, Education, and Welfare considers the health risks associated with asbestos exposure to be a serious and significant public health concern. The fact that exposure to the fiber has been identified in some schools does not make it the Federal Government's responsibility to provide funding for detection, encapsulation or removal where necessary.

We support, and are working with the Environmental Protection Agency (EPA), in its voluntary compliance program which offers information and technical assistance to the states and local units of government. However, at this time, the Administration has taken the position that the provision of additional financial assistance -- beyond the planned demonstration program and other presently authorized activities -- would exceed current budgetary limitations, and would expand the Federal role in education.

Assuming the Subcommittee proceeds with some legislation in this area the following specific comments on H.R. 1435 and H.R. 1524 are offered for your consideration.

Specific Comments and Analysis

The Department has some specific concerns about H.R. 1435 and H.R. 1524 as presently drafted. Both bills establish a program which will be extremely large and complex. The implementation and management of this system will require time and additional preparation by the states. There is an acute manpower and laboratory shortage to perform bulk analysis of samples suspected to contain asbestos fibers. There is a similar dearth of personnel trained to conduct containment and removal operations. The technology is available, but not on the scale contemplated by this legislation. There are 16,200 school districts across this nation which contain approximately 100,000 public and 18,000 private schools.

In view of these constraints regarding manpower and laboratories, the Department questions the feasibility of the time frame for state action as established in the legislation. With the requirement that state plans be submitted by September of this year, there are only four months within which the states are to complete their surveys and identification and just another eight months for removal to be completed. I might note that no deadline is given for completion of containment operations.

Both bills, as currently drafted, do not define clearly which entities of state or local government are eligible to receive funds or loans. Although states must submit plans for the inspection and removal of hazardous asbestos material, "units of local government with the responsibility for the administration and safety of schools" may receive payments from the Asbestos Hazards Detection Fund under Section 5(c) of H.R. 1524, and are eligible for reimbursement under Section 5 (a)(1) of H.R. 1435. Neither bill indicates what unit of government is eligible to apply for the Asbestos Control Loan Program.

Both H.R. 1435 and H.R. 1524 require the states to prepare a plan establishing a systematic program of inspection of all school buildings in order to identify the presence of hazardous asbestos or asbestos material. However, H.R. 1435 requires only those states which seek funding under the new program to submit the State plan notifying school administrators of the health hazards associated with asbestos and recommendations for addressing the problem. We believe the requirement in Section 4(a) of H.R. 1524, that states submit a plan irrespective of their intention to apply for Federal assistance, would create an unnecessary paperwork burden.

The loan program in both bills is limited to projects which are over 2,500 square feet. There is no provision covering schools with problems less than this size.

We have some concerns about the definition of "imminent hazard." The way it is defined in the bill is contrary to past Public Health Service usage of the term. "Imminent danger" is not defined.

A final issue which could prove significant is that of waste disposal of asbestos-containing materials. How and where are these materials to be placed once they are removed?

In H.R. 1435, the Act is authorized for an indefinite period of time with an appropriation of such sums as are necessary for Fiscal Year 1980 and for each of the succeeding years. The authorization in H.R. 1524 calls for an appropriation of such sums as are necessary but specifies only the years of 1980, 1981 and 1982 as the life of the Act. While no one can be certain of the extent and lingering nature of exposure to asbestos, a limited, three year program might encourage compliance.

Mr. Chairman, this completes our analysis of the two bills. I believe they are quite similar with the exception of the relationship established in H.R. 1524 regarding the obligations of the asbestos industry. At this time the Administration opposes enactment of any new program or assistance. We believe our present efforts, when completely carried forward, fulfill the proper Federal role in this area. HEW's activities, when combined with those of EPA, will achieve the goal of assisting the states in determining how to go about solving this problem -- without telling them how to do it and appropriating limited tax dollars for that purpose.

I would be happy to respond to any questions you or members of the subcommittee may have.

STATEMENT OF WILLIAM A. BLAKEY, DEPUTY ASSISTANT SECRETARY FOR LEGISLATION/EDUCATION, DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Mr. BLAKEY. Good morning, Mr. Kogovsek.

I would first like to ask that my statement be included in the record in its entirety, and I would like to summarize it briefly, focusing on the comments that we have on the bill.

Mr. KOGOVSEK. With no objection, that shall be done.

Mr. BLAKEY. I would like to say initially that we do appreciate the opportunity to present the Department's and the Administration views on the two bills before the subcommittee. We recognize, as does the chairman and Mr. Miller in particular, and the other members of the subcommittee that we have before us a very substantial problem.

However, for reasons which I will outline later, the Administration does have some problems with the potential budgetary impact of the two proposals before the subcommittee. Let me indicate also that the Department, in cooperation with the Environmental Protection Agency, has already taken several steps which have previously been alluded to before this committee in testimony by Dr. David Rall, who heads our Environmental Health Sciences Agency within HEW.

The specific comments that I would like to make on the bill should be prefaced by two general points, the first of which is, while we realize that we have a substantial problem here, the Department and the administration have some concern regarding what role should be played by the Federal Government in terms of financing the assistance as it is proposed in the two bills before the subcommittee.

Second, we are concerned about the potential budgetary impact, these bills might have.

Let me make some specific comments, however, on those parts of the bill that we think might be improved, assuming that the subcommittee is going to proceed with markup, as you have indicated, next week.

First, we have a very large and complex system which is contemplated in this legislation. From the Department's experience with this problem, we know that the implementation and management of this system would require time and additional preparation by the States. There is an acute manpower and laboratory shortage to perform the kind of bulk analysis of asbestos samples which may be suspected of containing asbestos fiber. There is also a lack of personnel to perform the removal and containment operations contemplated by the two bills. Given the large number of school districts and, in particular, the number of buildings, these constraints on manpower and laboratories make the time frame contemplated by the legislation infeasible, in our view.

The legislation indicates that States would have to submit plans by September of 1979 and within 4 months they would have to complete their surveys and identification, and come forth with the removal plans and in fact carry out the planned removal. Because of the problem of lack of laboratories and lack of personnel with the ability to carry out the kind of work contemplated, we think the time period is a bit to short to accomplish the stated objectives.

There is also a lack of clarity in the two bills in terms of who is eligible to receive funds. The phrase, "Units of local government with responsibility for the administration and safety of schools" is used in Mr. Miller's bill in terms of who may receive funds from the Asbestos Hazard Protection Fund; and under Chairman Perkins' bill that same phrase is used for purposes of defining who could be reimbursed for expenditures of detection funds. However, neither of the bills specifies who is eligible for an asbestos control loan, and that might present a problem in terms of assigning coordination responsibility in terms of whether or not the State should come in; whether the State educational agency should be the focal point; or whether public health agencies within the State government are the appropriate focal point for these loans, to coordinate them at the State level.

Both, H.R. 1435 and 1524 also require the States to prepare a plan establishing a systematic program of inspection of all school buildings. However, H.R. 1435 requires only those States who seek funding under the proposed new program to submit their plan. We believe the requirement in section 4(a) of H.R. 1524 that every State must submit a plan to the Secretary would create some unnessary paperwork if in fact those States are not planning to come forward and ask for a loan under the asbestos control loan program proposed in both bills.

A couple of other minor comments that I should make briefly. There is a limitation in both bills that only schools with 2,500 square feet would be covered. Because there is a fairly significant number of schools smaller than that which might also have asbestos related problems, we question whether or not the 2,500 square feet limitation should be applicable. From our own figures we believe that there are some 1,500 to 2,000 schools that would not be eligible under the program because of the square footage limitation.

One final issue that we think may be of significance, and that is, the bill does not indicate what would be done with the asbestos after it were removed. Obviously, of major concern is the escape of this asbestos containing material into the environment. We think it would be wise for the legislation to provide for some means of disposal so that we would be sure we would not be just moving the problem around, out of the schoolbuilding and into some other area where it might cause additional public health problems.

Finally, let me say that we believe both bills are quite similar, with the exception of the provisions in H.R. 1524 regarding the obligation of the asbestos industry to contribute to a proposed fund. At this time the administration does oppose enactment of any new program of financial assistance. We believe that our present efforts at HEW in coordination and cooperation with the Environmental Protection Agency will fulfill the proper Federal role here and because of budgetary considerations we could not support enactment of this program at this time.

If you have any questions I am more than happy to try to answer them.

Mr. KOGOVSEK. Thank you, Mr. Blakey, for your testimony. Are there any questions from committee members at this time? Mr. Kildee?

Mr. **Kildee**. Just one comment to indicate that as usual, you have given us some good points to help us to perfect this bill. I think your suggestions, for the most part, are to help us perfect the bill.

Mr. **Kogovsek**. Mr. Hinson, do you have any questions at this time?

Mr. **Hinson**. I have no questions.

Mr. **Kogovsek**. Let me ask, Mr. Blakey, if the time situation that we are looking at under both bills is a reasonable amount of time to solve the problem.

Mr. **Blakey**. I guess there are two ways to look at it. From our perspective, and based on the studies—especially the Mount Sinai study which has been supported with funding through HEW—two things must be looked at, one of which is the problem of what kinds of facilities are available to carry out the kind of examination that would be required. As I have indicated in my testimony, there is a problem there simply because there are not a lot of people capable of doing the work, one, in terms of the laboratory analysis, or in terms of carrying out either the containment work or the removal work.

Obviously, too, from a time point of view you have to be concerned about when you are going to do this. You cannot do it, realistically, except when school is not in session, which means you could probably only do it during the summer months. So, the timing has to be, I think, related obviously, one, to funding if the authorization legislation were passed; and, two, making sure that the States have the ability to carry out what the legislation would be requiring and then, when would they carry it out.

Some States have already moved ahead in this area. Some are, realistically speaking, probably in no position—either financially or staffwise—to move forward without substantial technical assistance from the Federal level.

I think those three things would have to be kept in mind in terms of the time frame.

Mr. **Kogovsek**. It is quite evident from some of the questions that I will ask this morning that I am not as acquainted with the problem as I should be, but it seems to me that we are in a situation where even under a removal process, that causes further complications in other areas. Moving any kinds of asbestos materials around seems to complicate the problem. Once you remove it from the school, there is the potential of having it out on the streets. I do not know what the answer to that is, and I assume you do not, either.

Mr. **Blakey**. Well, most of our knowledge in this area is fairly limited, at least as it affects schools. What we have tried to find out and what we are finding out, I think, will be helpful; it should be useful, at least, before we embark on a major effort.

Mr. **Kogovsek**. Sure. If you would remain and be available for further questions, I would appreciate it.

Mr. **Blakey**. I can stay for a while, Mr. Chairman. Karen Hoffman is here, she works with Dr. George Rall at our Environmental Sciences Agency in HEW, and she will be here and have a good deal of technical knowledge, although she is not as familiar with some of the policies. I will stay as long as I can.

Mr. **Kogovsek**. I understand you have a plane to catch.

Mr. **Blakey**. I have a plane to catch.

Mr. **Kogovsek**. At this time, if we could hear from Mr. Anthony Smith, who is the executive director, Division of School Buildings, New York City Board of Education.

Mr. Smith, it is a pleasure to have you here this morning and we are looking forward to your testimony.

[The statement of Mr. Smith follows:]

TESTIMONY OF ANTHONY R. SMITH
EXECUTIVE DIRECTOR OF THE DIVISION OF SCHOOL BUILDINGS,
NEW YORK CITY BOARD OF EDUCATION
BEFORE THE HOUSE OF REPRESENTATIVES EDUCATION AND LABOR COMMITTEE-
SUBCOMMITTEE ON ELEMENTARY, SECONDARY AND VOCATIONAL EDUCATION,
WEDNESDAY, FEBRUARY 21, 1979, 9:30 a.m.
RAYBURN HOUSE OFFICE BUILDING - ROOM 2175
WASHINGTON, D.C.

I am Anthony R. Smith. I am the Executive Director of the Division of School Buildings for the New York City Public Schools. Once again, on behalf of the Chancellor of Schools, Frank J. Macchiarola, I want to express appreciation to Committee Chairman Congressman Perkins for inviting me to testify on these important matters on behalf of our School System.

I might also say to the Committee Chairman, Congressman Perkins and to Congressman Miller of California, and to all members of the Subcommittee that all of us involved in developing, executing and implementing the asbestos abatement program in New York City are profoundly grateful for the fact that these hearings have taken place and, more importantly, the speed with which legislation has been drafted and this hearing is taking place. That speed and the thoughtfulness which is manifest in the two bills, HR 1435 and HR 1524, reflect recognition of the extent to which this is a national problem which knows no state or regional boundaries, is obviously not partisan and is motivated by one underlying national, common concern: to make the academic environment for our children and working environment for our teachers and staff as safe as possible and to render it more safe as quickly as possible. Clearly that sentiment is shown in letter and spirit in the bills of both Mr. Perkins and Mr. Miller. We are indeed grateful.

When I testified before this distinguished Subcommittee on January 8, 1979, I described in my written testimony the magnitude and scope of the problem we confront in New York City. Briefly to recapitulate, we have nearly 1,100 school buildings and a total of almost 1,500 facilities, including those school buildings plus administrative buildings, field house and other structures which we either own or lease. To date we have inspected 932 of those structures. We have identified materials which do, might, or which we at first thought did contain asbestos in 408 schools.

I am pleased to report, Mr. Chairman, that we are living proof of the validity of the approach described here on January 8, by Dr. Robert N. Sawyer of Yale: we are basing all of our operational and engineering decisions on the results of bulk samples, tested in a qualified laboratory, to determine absolutely whether or not asbestos does exist in the suspect materials. The results of the test so far indicate that of 191 schools, with what appeared to be asbestos-containing acoustical plaster, 132 (or 70%) do not contain asbestos. The acoustical quality in the plaster is provided by cellulose. The testing continues and we do have confirmation of asbestos in 144 schools.* We estimate the cost of abatement project in those schools to be somewhere between $15 million and $20 million. The foregoing results were derived from laboratory analysis of 312 samples. We have an additional 309 samples which are at the laboratory for analysis or are being prepared for submission to laboratories. Additional premises are still to be surveyed. The total findings could lead us to another $15 million which will have to be expended, leading to an overall total of $30 million to $35 million.

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* Acoustic Plaster - 55
Spray-on Retardant- 33
Spray-on Acoustic - 19
Transite panels,
etc.- 37
144

You may also be interested in knowing that to date, we have expended $240,000* on our survey and testing program which includes education and training not only for our own personnel but for contractors who are interested in bidding on future projects.

I would like now to speak briefly about the two bills we are here to discuss today: there are many similarities between the two bills and I find that, for the most part, they address problems of the type confronting administrators such as myself.

I shall speak to several general problems:

1. When I testified on January 8, 1979, I stated that I hoped, and frankly I assumed, that any legislation proposed would have retroactive features in it, so that the few school districts, such as New York City, which had aggressively pursued an asbestos survey and abatement program, would not be penalized for having recognized the problem and started to deal with it without waiting

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* Lab analysis	- $17,000
Surveys & Sampling	- 190,000
Admin., etc.	- 33,000
	$240,000

for those bills to become law. I would respectfully suggest that the final bill include retroactive provisions to apply the cost sharing formula for the cost of surveying, sampling, laboratory testing, and the development of an asbestos abatement program, as well as the loan program for the cost of that program itself. I would suggest as a starting date, January 1, 1976. I pick that date because it was in that year that Howell Township, New Jersey led the way for many of us. It was also in that year that New York City's Board of Education made its preliminary effort to survey the extent of the problem in our facilities.

We have been keeping very careful records of our expenses and we feel it would really be unfair were we rendered ineligible to participate fully in a federal program simply because we met our responsibilities and started when we did. If I might speak with some pride, I would also note that the program that we are deveoping in New York may begin serving as a model for other jurisdictions; also, we are working closely with various federal agencies to share with them our experiences and to save others the pain of the same learning curve that we have been on so intensively for the past 100 days.

2. Both bills suggest the creation of a task force at the federal level. I think this is an excellent suggestion and I note that both provide for the inclusion of representatives of public organizations concerned with education and health. I think this is a wise provision and the federal task force would be well served to have representatives of state or municipal agencies or school

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boards, such as my own, which have had "hands-on" experience in developing a complex and extensive survey, testing and abatement program.

3. The concept of the asbestos hazard fund, funded by payments from companies which mine, manufactured, or imported asbestos, seems appropriate and seems a particularly appropriate way for the private sector to help to share some of the cost which it is responsibile for causing so many school districts to have to bear. While the concept is good, I would hate to let this, the most original idea in either bill, be the cause of delay because of debate and/or litigation. Perhaps the final bill could permit HEW to prospectively bear these costs,to be reimbursed later when, as,if and how the hazard fund is created, and contributions duly made.

4. Both bills at several points speak in terms of "imminent" hazard or "imminent" danger to the health and safety of children and school employees. May I respectfully suggest that "potential" is really the problem we are talking about. As you heard on January 8, 1979 from various experts, no one can really describe with certainty what constitutes an imminent hazard. But we all know what constitutes a potential hazard and that is, of course, the existance of asbestos-containing materials in our schools in such a way that they can introduce fibers into the environment of the school. It is that potential which we must deal with.

5. For that same reason I would suggest that the final legislation not contain any reference to a specific percent of asbestos in non-inert asbestos-containing materials. Since we do not know what is a safe level, whether we are dealing with 1% or 85%, it seems to me that the material should be removed, isolated or encapsulated, if it is exposed, potentially exposable and damaged or potentially be damaged or disturbed.

6. Much attention has been focused on the problems associated with asbestos that was sprayed-on either for acoustical or fire retardant purposes. When I testified on January 8, I stated that I felt that emphasis could be misleading. No one questions that those sprayed-on materials may cause the greatest potential problem in our schools, but as I have indicated we, for example, in New York City have acoustical plaster, which is trowelled on, not sprayed-on, in 361 of our schools. We have tested that material in 191 and, fortunately, in only 59 (30%) of those tested to date, have we found that the acoustical plaster contains asbestos. But where it does contain asbestos, the material is soft and is and has been easily damaged in the school environment through accident, play, or vandalism. I think it imperative that the legislation which finally emerges not be restrictive or ignore the problem posed by that use of asbestos. Similarly, the asbestos material used to wrap pipes which will be found in many of our buildings can be a potential hazard if the pipe is itself accessible

for students or custodial personnel in such a way that they can deliberately or inadvertently damage the asbestos-containing insulation. In summary, what we are talking about is containing, isolating or removing asbestos-containing materials, when they are not inert, such as one finds in floor tiles, for example, and where that material is currently or potentially accessible to any personnel in their normal use of the school.

In concluding, Mr. Chairman, I would like to reiterate the point I made at the outset and also mid-way through my testimony: speed is of the essence. The fact that asbestos has been in many thousands of schools around this country for many years does not mean that we have the luxury of time to develop a whole series of intricate and complex federal formulae, sort out bureaucratic differences at the federal, state or local level, nor even spend a great deal of time wondering where the funds will come from and how we can afford to meet what is so clearly an unavoidable responsibility to our most precious national resource - our children.

The speed with which the Subcommittee has already acted demonstrates conclusively that those of you who have heard medical, scientific, and engineering experts, as well as a few of us from the "trenches," have received, understood and acted on this message. We appreciate that enormously. What must now happen is that that message must be transmitted throughout, to the Members of the House of Representatives and the Senate and to the President of the United States. We must act - that we know. It will take time for us to fully act - that we know. It will be enormously expensive - that we know. We need help - technical and financial - that we know. Too often, Congressional committees are importuned by narrow, special interest groups seeking their own aggradizement and which are willing to accept it at any price and at the expense of other groups - that we know. All of us who have testified before the various hearings of the Subcommittee believe we are speaking for all parents, for all children, for all teachers and for all administrators in all schools throughout the country in turning to you to ask every possible assistance in providing wise counsel, technical assistance, training and educational programs and materials, and, finally, and most critically, the financial aid to enable us to meet the responsibilities from which we cannot flinch or shirk.

Thank you, Mr. Chairman.

STATEMENT OF ANTHONY R. SMITH, EXECUTIVE DIRECTOR, DIVISION OF SCHOOL BUILDINGS, NEW YORK CITY BOARD OF EDUCATION

Mr. SMITH. Thank you, Mr. Chairman.

I am Anthony Smith, I am executive director of the Division of School Buildings of the Board of Education of New York City.

I have had the honor of testifying before this subcommittee on January 8, 1979, and I notice there are a number of new faces on the subcommittee. I might, at the risk of being repetitive for Mr. Kildee, repeat a couple of points that I made when I spoke before on behalf of the chancellor of schools, Frank Macchiarola.

The magnitude of the problem confronting New York City is, as always with New York City, somewhat overwhelming in terms of the size and the scope. We have approximately 1,100 school buildings in New York City, including those we own, which are almost a 1,000, the remaining, a 100 or so, which we lease. We have a total of 1,500 facilities that we are accountable for—including field houses, annexes, administrative buildings, and so forth.

The efforts of New York City to determine the extent of the presence of asbestos-containing materials began in a rather preliminary fashion in 1976–77, following the Howell Township, N.J., example. We did not—I regret—get fully under way until November 1, 1978, in terms of a comprehensive survey, followed by analyses in a laboratory of bulk samples taken of materials suspected of containing asbestos. To date we have examined 932 of our structures.

The initial visual survey led us to suspect asbestos-containing materials in 408 schools. That is the bad news.

The good news is that in 191 cases bulk samples tested by a competent laboratory, MacCrone in Chicago, found that in 132 cases the material which appeared to contain asbestos in fact contained cellulose as the acoustical material. That was a 70-percent negative response and, needless to say, enormously gratifying. I think not just gratifying in terms of the $10 or $15 million that we had anticipated having to spend in those 132 schools for an abatement program, but gratifying because it confirms much of the testimony given the subcommittee on January 8 as to the procedure and the methodology which we followed. We believe it has worked almost as an enormous textbook example of what Dr. Robert N. Sawyer described as the appropriate way for a school system to approach its problem.

We did not make operational decisions on the basis of air sampling and in fact ruled out air sampling as playing a role in determining what we should do. We did take bulk samples and had them analyzed according to the one appropriate method which can absolutely determine whether there is asbestos present, and we have proceeded from there.

The testimony that I have this morning, Mr. Chairman, deals specifically with comments on the two bills that I was asked to discuss, H.R. 1435 and H.R. 1524. As has been noted by the previous witness, they are virtually identical, with one major exception. So, until I deal with the concept of the fund, the comments that I am making really apply to both bills.

When I spoke on January 8, I urged the subcommittee to insure that any subsequent bills that were produced and hopefully legislation enacted, contained sufficient retroactive features to insure that school districts such as New York City would not inadvertently be penalized for having recognized, acknowledged, and acted on responsibilities to proceed without awaiting and hoping that some kind of Federal legislation would be forthcoming.

I did not find such retroactive provisions in either of the two bills, and again respectfully and urgently request that whatever does emerge contains such a feature. I suggest you might consider January 1, 1976, as a retroactive starting date. I pick that date not arbitrarily, but because it was in 1976 that Howell Township, N.J., and the rest of the State of New Jersey incurred considerable expenses and, frankly because that is the year in which we made our first preliminary survey. There may be arguments for making it an earlier date than January 1, 1976, but from my perspective it seems to me that that is an appropriate date.

I might add that we have been keeping extremely careful records of all the expenses that we have incurred to date, as optimists, that we might have an opportunity to make those records available to someone. I hope you will give us that chance.

I think the concept of the Federal level task force which both bills propose is a useful one, and I think that both essentially suggest that there be representatives on that task force with jurisdictions like ours, and perhaps even with individuals like myself that have had hands-on experience in dealing with the problem. I can only suggest from the distance—geographic and bureaucratic—between those who administer an enormous Federal program and those of us who are in the trenches, that we feel—and I presume to speak for many others in positions similar to my own—that it is very important that that immediacy and that sense of reality be brought to any effort to coordinate on the Federal level. It is a complex problem, there is no question, bringing together all the

Federal executive branch agencies that either are or could be involved in a massive asbestos abatement program.

I think the concept of having representatives from those dealing with the implementation of the policies and the legislation is an excellent proposal.

As far as the concept of the fund is concerned, it certainly is the most original concept in either of the two bills. You have a better sense, I am sure, Mr. Chairman, than I can bring of how realistic it is to anticipate that such a fund could be created. I think both of us would have to agree that it may be the subject of extensive debate and eventually litigation. I would hate to see either legislation or its implementation delayed by being dependent upon the whole creation of the funding of that fund throught contributions. I would hope that perhaps the final bill, if it does contain the concept of the fund, would permit HEW to prospectively advance funds, and then HEW would itself be reimbursed when the funds were created. That way you will not stay us in our course which, despite what was suggested from the previous witness, I happen to believe is urgent. I think it is critical. I think it is not responsible of those of us who acknowledge the problem to not move expeditiously.

Having said that it may appear contradictory for me to note that one of the problems I found in both bills is the repeated reference to the imminent danger or hazardous situation. There was extensive testimony submitted on January 8, 1979, to the subcommittee, which deals directly with that point. Medical science has not been able to establish the appropriate thresholds to speak definitively to the question of what is imminent in the way of a hazardous condition or a dangerous presence of asbestos.

I would again suggest that it would be appropriate to change the word "imminent" to "potential" in every case because it is the potential hazard with which we are forced to deal. We cannot await the 25 or 30 years for medical data to be aggregated and analyzed to determine what is in fact an imminent hazard.

For the same reason, one of the bills contains a blank in front of the percent of asbestos which might be permitted without an abatement program, and I believe one of the bills contains a percentage. Again I would suggest that no percentage be considered safe in the sense of that potential hazard since we know so little about it. I think that the real question is, if there is an asbestos content in any material present in the school, the question as to whether that material can be left alone or whether it must be removed, or isolated, or encapsulated, relates to whether that material is exposed or potentially exposable, and whether it is damaged or could be damaged or disturbed. Those are the key criteria, not the percent of the asbestos. If it is damaged, no matter what the percent of the asbestos in the material, fibers can become airborne and enter the used environment of the school.

The question is how it is used, where it is, and what its potential is for being disturbed.

Another point I might make that I did speak to on January 8, and I repeat now because I think the legislation goes in that direction and it concerns me, there has been enormous attention paid to the issue of sprayed-on asbestos materials—whether it is used for fire-retardants or acoustical purposes.

We have asbestos ranging, I suppose, anywhere from 5- to at least 25-percent content which was put into an acoustical plaster and troweled on. Now, it is definitely more dense and harder, more cementitious, as the engineers say, that the sprayed-on material; it does not have that very flaky quality that we have discussed extensively. It is, however, a great deal softer than regular plaster and, given the imagination, creativity, strength, whatever qualities you wish to endow school children with, it can be damaged, and it has been extensively damaged in many, many of our schools. Damage means airborne fibers.

I have urged that EPA in the construction of its guidance documents focus on that, and I hope that the legislation is not written in such a way that it is either explicitly or implicitly restrictive of assisting schools which have used asbestos in this form, to deal with the problem.

To give you a sense of proportions, we have troweled-on acoustical plaster in at least 361 of our schools. Now, it is that use that I referred to when I started speaking, where we found 70 percent of the acoustical plaster has its acoustical qualities through cellulose, rather than asbestos. But. that leaves a remainder, so far, of 144 schools that do have asbestos in that plaster. That has been confirmed by laboratory bulk analysis. Just within that group of schools we are talking about, probably, $15 million in terms of the appropriate abatement procedure which is in this case not removed, it is dry-wall containment.

So, I think it is critical that the legislation contain flexibility to insure that asbestos materials used in any noninured form may be eligible. The inured use of asbestos would be floor tiles, for example. There, short of applying a power tool, there is no danger of a fiber release and we do not intend to deal, in an abatement program, with that use of asbestos.

Finally, Mr. Chairman, I want to express the thanks of all of us who are involved in this issue for the speed with which the subcommittee has acted in drafting this legislation. I am afraid I may have sounded as though I found many, many problems with it. Obviously, all of us who are ultimately on the receiving end would have preferred to see legislation that proposed an outright grant or a formula. I think one bill proposed a 90-percent Federal, 10-percent local funds formula. I think I am realistic enough to know that the two bills we are speaking of today may contain the most optimistic proposals possible. I welcome that and the speed with which they have been circulated.

I think the road ahead—as far as we have gone, and I say with some pride that I think we have become for many a model and have literally thrown open the doors of our schools to any who wish to come see what we are doing. We have offered to provide data. God knows, we made some mistakes. It is like going through a maze and there are an awful lot of false paths down there; one has to be very, very careful. We would like to assist any of our fellow school districts around the country from avoiding those false starts. false paths. They are expensive, and more importantly, they are time consuming. When you have to back up and start again it is a problem.

It is a problem particularly because, as I said when I spoke before, we are dealing with love and fear, and I think we have to address that aspect and not speak just as engineers or scientists. We so need help, we need it very quickly.

That is all, Mr. Chairman.

Mr. Kogovsek. Thank you, Mr. Smith. Let me ask you one quick question. Earlier in your testimony you had indicated that you would like to see in the bill a January 1, 1976, retroactive—or that as the date of retroactivity, I assume, for the Federal Government to come back and in some way finance the work that your board of education has done in this area since 1976.

Mr. Smith. As I said, Mr. Chairman, I do not want to sound parochial in picking that date. I picked it because I think the Howell Township, N.J., incident really focused national attention on the problem in that year. It is the date at which we began our first survey and testing. We did practically no abatement during that period—none, really, except on a sample basis.

So, what I am really referring to is recouping for any jurisdictions the cost of survey and testing that went on. There may be some that did go into an abatement program earlier, or as early as 1976. We certainly did not, we are talking about the surveying and testing, primarily.

As you can imagine, however, with a system as extensive as ours, that alone is very expensive. We have expended well over $200,000 so far just on surveys and tests.

Mr. Kogovsek. I might have missed a figure in your testimony. Do you have a ball park figure that your board of education has spent in this whole area since 1976?

Mr. Smith. The actual expenditures to date are primarily the $200,000 or so that have been expended on surveys and sampling. Another roughly $17,000 was expended to date to pay the bill of the laboratories to do the analyses. That figure will probably triple. Administrative expenses we have estimated a little over $30,000. That really reflects primarily what we estimate to be the time of city employees who have gone out and taken the samples. So, our total expenditure of $240,000 to date in that area, and probably another $200,000 or so in terms of time and materials expended by our own people during the Christmas recess doing work on approximately 12 schools. Finally, we are in the midst of and will conclude in about 2 weeks the expenditure of another $125,000 in fully abating the school which triggered this whole problem, starting in early November of last year.

So, the sum total to date is probably under $500,000. Our prospective expenditure, however, is now in the neighborhood of about $35 million for a full abatement program.

Mr. Kogovsek. How much?

Mr. Smith. $35 million.

Mr. Kogovsek. Mr. Miller, do you have any questions at this time?

Mr. Miller. I have no questions. Thank you for your testimony today.

Mr. Smith. Thank you, Mr. Miller.

Mr. KOGOVSEK. Mr. Kildee?

Mr. KILDEE. Not that I suggest in this bill we add in that expense, but will there not be a continuing expense over a period of years where the method of encapsulation is used, rather than removal? In other words, you would have to monitor very carefully those schools where you would contain the asbestos material.

Every expense is significant, but how significant would that expense be in the case of New York City of monitoring and tracking those schools where you used the method of containment, encapsulation?

Mr. SMITH. I do not mean to sound facetious, but I am glad you asked that question, sir. I think that it is a question that we have focused on intensively, and again is one which, until we begin to make a lot of noise about it, I think had been essentially ignored by many points in the Federal Government that are dealing with this. It is one which has not been dealt with very extensively. When asbestos is being left behind in schools—and we will be leaving it behind, as I said, in early January, in hundreds of schools, using this containment or encapsulation technique. Primarily when I am using this term "encapsulation," I am referring to the spraying on of a substance that will enclose the material. That will not be used very extensively in our school system simply because it remains vulnerable to damage, vandalism or play, or whatever.

Primarily, we will be using a dry-wall containment to put a strong physical barrier between the wall or the ceiling use of the acoustical material and the use environment. We are installing what I would call a series of management screens through which anyone going into the buildings to do repair work will have to pass. A list of the schools that contain the asbestos and where the asbestos is, will be at our contract management unit, will be at our central shops, will be posted on the wall of our custodians, and each school has a custodian in it. There will be a schematic map on his wall that shows—using color codes—where the material is.

Each person going in to work on our schools now must sign into a log book. Those schools which have asbestos, we will quite literally stamp in bright red at the top of every page of those log books the word "Asbestos". If they still get through all of that, we have devised a symbol which I think perhaps EPA may decide to try to make a national symbol. It does not contain the word "Danger" or "Asbestos," it simply is in the shape of a stop sign and has the word "Stop" in big, bold print; and the words, "Check with custodian before working in this area." Separately affixed there are arrows which will point in the direction that the workman is not supposed to proceed. So, if the material were in the ceiling, this would be along the top of the wall, pointing up; or in the center of the ceiling with four arrows pointing out.

It is a very simple, and we hope, effective final screen. The point here is obviously that institutional memory is very short. I suppose in some ways the subcommittee is an example of that, people change in government. What one has to do is to insure that the memory is available, is obvious, and simply cannot be circumvented, to assure that work done where we have in our opinion responsibly made the decision to leave asbestos behind, is not irresponsibly overcome through inadvertence or lack of attention.

The problem is extensive, it should not be particularly expensive to maintain in the sense that once the system is in place it really ought to be a fail-safe system. It is simply a matter of those who have the administrative responsibility of looking at lists when they write a contract for work to be done in the school to be sure they checked it off against the list of known asbestos presence.

It will not be infallible because it is a human system, but it will be as close as we can make it. I think if there is anything that we are doing in New York that I hope we can assist others to pick up on, frankly, it is this management control system.

Mr. KILDEE. I would think that is an extremely important matter if we are going to use the process of containment. Work very often is done by people in the school or by outside contractors. It is very important that they would know when they were removing something—whether or not they are disturbing asbestos. A very careful log would have to be kept to assure they would not release any into the ambient air.

Mr. SMITH. To the point, Mr. Kildee, we have found in a number of schools that even the most careful repairman cannot in some cases even change the fluorescent tube without inadvertently going up against a very flaky, asbestos-containing fire retardant. In a case like that we have to remove the material because there is no way to prevent that in the future.

But there are other cases where one may not choose to remove, but on the other hand where it is not vandalism and it is not carelessness, it is simply the way the building was put together in the first place. We believe that this will help.

Mr. MILLER. Will the gentleman yield?

Mr. KILDEE. Yes, I will yield.

Mr. MILLER. The fact that H.R. 1524 allows for retroactive qualifications, does that meet with your approval? Do you believe that would allow you to come in and apply for work that you are now doing?

Mr. SMITH. I am not a lawyer and obviously not a legislator, Mr. Miller——

Mr. MILLER. Well, your city is full of them.

Mr. SMITH. I am not sure whether the paragraph you are referring to, it did not seem to me—the way I have been reading it—that it was broad enough to provide the retroactive protection that we are seeking. It seemed to me that it was dealing more with the 120-day period from the enactment of the legislation. Perhaps I have misread it.

Mr. MILLER. Our intent is to provide for that retroactivity. So, you might have somebody in your organization take a look at that before we mark it up because we will attempt to clarify that, if it is not clear.

Mr. SMITH. We have, as you perhaps know, a legislative representative here in Washington, Fern Lapidus, who is sitting here behind me. I have given her our suggested changes for your markup session which, I think, deal with that, among other things.

Mr. MILLER. Thank you.

Mr. KOGOVSEK. Congressman Erdahl?

Mr. Erdahl. Thank you, Mr. Chairman. I am sorry that I came in late because of another meeting.

Mr. Smith, is the main thrust of your presence here to try to see that we either allow for the containment, you talked about the encapsulment—if that is the word—of the material that contains asbestos and has a potential danger to students, teachers, or employees; or is your main thrust to see that this committee and the Congress would make it retroactive? I think I saw 1976 for your city and perhaps other major systems that would be involved in the cost?

If I could have the indulgence of the other Members, could you just summarize the main thrust of your appearance here this morning.

Mr. Smith. Mr. Erdahl, we have made the decision because we felt we had to, we have the responsibility to deal with the questions of asbestos in our schools; that is a given. I do not need to bore you with what a strain an unexpected expenditure in any jurisdiction, but particularly in New York City, can be. We are talking in the area of a $35 million expense, which we feel simply has to be made.

I am here in part to request the retroactivity features be precise, and complete, and flexible enough to assure the expenses we have incurred prior to enactment of whatever legislation does emerge, is available to us.

That is, however, not my principal concern because we have not, frankly, even expended a fraction of the $35 million yet. My primary concern is to ensure that some form of assistance be forthcoming from the Congress to assist, again not just New York City, we are big, but we are a fraction of all the school jurisdictions in the country. Whether it is one school in Prestonsburg, Ky., which has an extraordinary problem, or whether it is 300 schools in New York City, obviously, it is not regional; it is not partisan, it is a national problem.

A national problem, I think, requires action on the national level. That is really why I am here.

Mr. Erdahl. Mr. Smith, thank you for that synopsis. No further questions, Mr. Chairman.

Mr. Kogovsek. I believe Dr. Joseph Highland is here in place of Mr. Leslie Dach, is that correct, of the Environmental Defense Fund?

Mr. Rauch. Dr. Highland was unable to come.

[The statement of Dr. Highland follows:]

PREPARED STATEMENT OF DR. JOSEPH H. HIGHLAND

Good morning. I am Dr. Joseph H. Highland, chairman of the Environmental Defense Fund's (EDF) Toxic Chemicals Program. With me this morning is Mr. Robert Rauch, Washington Counsel of EDF.

The Environmental Defense Fund is a non-profit public interest organization whose efforts are directed at minimizing environmental pollution and thereby protecting public health. EDF has over 45,000 members who are lawyers, scientists and private citizens who are concerned about environmental quality and many of whom will be directly affected by the legislation under consideration today. For more than 10 years, EDF's Toxic Chemicals Program has attempted to minimize human exposure to hazardous chemicals, through efforts aimed at affecting regulatory decisionmaking and Congressional legislation. We have in the past been quite active on issues involving human exposure to asbestos and have developed both extensive scientific and legal expertise in these matters. Our latest effort in this area related directly to the matters under consideration today, and involved the filing of a petition on December 21, 1978 with the Environmental Protection Agency (EPA) seeking comprehensive regulatory action to identify and eliminate asbestos hazards in public schools. We welcome, therefore, the opportunity to appear before this committee and share with you our views on the bills currently under consideration by this committee.

We would like to divide our remarks into two sections. The first will deal with the relationship between the proposed legislative action and current EPA regulatory efforts as well as those actions we are seeking in the petition filed with EPA. The second will be detailed comments on specific sections of the proposed legislation.

General Comments

Both bills that have been introduced, H.R. 1435 by Mr. Perkins and H.R. 1524 by Mr. Miller, set forth a two-part program aimed at eliminating asbestos problems in the public schools. The first part of the proposed program calls for funding of an inspection plan aimed at identifying potential asbestos hazards. EDF strongly believes that any inspection program should be aimed at identifying all potential asbestos hazards in the public schools and not just the most egregious ones. We recognize that different responses will be appropriate depending on the nature of the hazard identified. However, it would be inappropriate not to seek to identify all potential problems, even if those identified will be treated differently in terms of the nature of the repair necessary and/or the time period allowed to accomplish the necessary work. We therefore urge the committee to clearly indicate in the language of the proposed legislation that inspection programs should be comprehensive in nature and not limited to identifying only the worst case situations.

The second part of the program is designed to provide funds for repairs deemed necessary in order to eliminate asbestos hazards. Such a program parallels closely the regulatory approach that we have sought to have instituted by the EPA under the Toxic Substances Control Act (TSCA) as well as the voluntary program purportedly undertaken by the EPA.

EDF therefore supports the conceptual approach offered by the proposed legislation and sees it as a meaningful step in efforts to eliminate asbestos problems in the public schools. However, EDF is concerned that the proposed legislation has no mechanism for enforcement to ensure that necessary repair work, once identified, will be carried out. While the establishment of state plans to ensure proper inspection is comprehensive, the value of such efforts may be lost unless necessary repair work is performed.

Two options exist for ensuring that necessary repairs are made. One would be to include in the legislation an enforcement provision under the authority of the Secretary of HEW. In the alternative, the members of this Committee and the authors of the legislation could make it clear that while the funds necessary to carry out repair work may be provided by this bill, the regulatory authority of EPA to enforce such repair programs is recognized, and no way mitigated by the enactment of this legislation. Specific language should be part of this Committee's report instructing EPA to move forth immediately under their existing regulatory authority and to in no way construe the enactment of this legislation as limiting its responsibilities under TSCA or other statutes. In this way, the legislation as proposed would complement and support the efforts that can be undertaken, and in our belief should be undertaken, by the EPA.

From the beginning it has been recognized that local school boards would need some form of financial assistance to both identify and repair asbestos problems in the public schools. While the EPA has ignored this need by sponsoring its voluntary program, we have sought in our petition to have the Agency recover funds from the asbestos manufacturers and sprayers in order to aid school boards in the job they have to do. We believe that the EPA has the regulatory authority under TSCA to seek such funds, and feel strongly that those responsible for creating such public hazards should likewise be responsible for helping to eliminate them. Otherwise, an incentive is created to pollute without concern, knowing that the federal government will be there and come to the rescue if problems become evident. We already have had too many examples of cases in which state and federal funds have had to be allocated to clean up hazards caused by private industry. One need only recall the tragedies of Kepone in Virginia and PCBs in the Hudson River in New York or the Love Canal disaster as examples.

There is no question that even as far back as the early 1950's the asbestos industry knew that exposure to asbestos increased one's risk of getting lung cancer. It was impossible then, and still is now, to establish that a safe level of exposure to asbestos exists and consequently it should have been clear to the industry that the use of sprayed asbestos materials in the public schools was improper.

In the bill introduced by Mr. Miller, an asbestos fund is established in order to provide financial assistance to states for the inspection of their schools. We support such a provision. While Mr. Perkins' bill also provides for financial assistance to aid local schools with an inspection program, it relies on public monies to support such a fund. We therefore would like to suggest an alternative approach which combines the elements of both Mr. Miller's and Mr. Perkins' bills.

Both bills provide for up to 50% reimbursement of expenses for the costs of an inspection program. Mr. Perkins' bill also has a provision that with the approval of the Secretary of HEW additional reimbursement monies can be given. However, since for most situations schools will receive only 50% of their costs, we would like to suggest that a fund be created from which schools may be totally reimbursed, and that half the monies for this fund come from payments by industry and half from public monies. Such a funding base would draw its support from the sources proposed by both Mr. Perkins and Mr. Miller and would supply even greater assistance at the local level. Furthermore, it would allay the fears that some members of this Committee have expressed that a fund established solely from the contributions of the asbestos industry might not actually be immediately available to schools in need if the industry litigated the validity of the establishment of such a fund. Even if industry did successfully challenge or delay payment of its 1/2 share, the school districts would still be assured of receiving 50% of the needed inspection funds immediately.

It is essential that no matter what funding proposal is finally adopted it be made clear in this legislation that expenses incurred for inspection programs prior to enactment of this law will be subject to reimbursement under the same provision as those which will occur subsequently. Otherwise, a great disincentive will be created for immediate action, and school boards and responsible authorities will postpone the critical task of

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identifying asbestos hazards until they are sure that they will be able to receive financial assistance.

Both bills call for the establishment of loan programs to aid schools with repair work that is deemed necessary. We support such a program and urge that consideration be given to expanding it. We feel that any program designed to aid in eliminating identified asbestos hazards should have the broadest possible applicability. In some cases, the problems with asbestos-containing materials may be so egregious as to require the removal of these materials and their replacement. In other cases, however, it may be possible to chemically seal or encapsulate asbestos-containing materials. We believe that financial assistance should be available to aid in both these types of necessary repair work, and suggest that this committee consider providing grants for the removal and replacement of the most serious asbestos hazards and long-term no-interest loans for other types of repair work which are preventive in nature and designed to avoid problems in the future.

Second, we suggest that the legislation contain a specific directive to EPA to use whatever authority it may have under the Toxic Substances Control Act and other statutes to recover from the asbestos manufacturers and processors any grant or loan monies provided by the treasury. This would have several advantages. First, it will provide EPA with a clear signal to proceed under TSCA or other statutes and thus insure that action is taken to shift the ultimate financial responsibility to those parties which should rightfully assume it. Second, and perhaps more important, it will reduce the drain on the federal treasury at a time when we must watch every dollar in order to slow inflation. Finally, it will insure that school districts get the money quickly in order that the problem can be solved as soon as possible.

Specific Comments

Turning now to the specific comments we have on the proposed legislation, we would like to make the following points. H.R. 1435 and H.R. 1524 have many of the same provisions, but have different section number designations for these provisions. The reference to section numbers we will make is with respect to the bill introduced by Mr. Miller, H.R. 1524. Clearly, however, these comments are applicable to the appropriate sections of the bill introduced by Mr. Perkins, H.R. 1435.

Section 2(a)(1): EDF suggests that the language here be changed to read as follows:

> "Exposure to asbestos has been identified by reputable medical and scientific evidence...".

It is exposure to the asbestos in a material such as insulation, and not exposure to the material containing asbestos per se that is associated with increased disease. Therefore the suggested language more accurately states what is known about health hazards posed by asbestos.

Section 2(a)(3): EDF suggests that an additional sentence be added indicating that, because any exposure to asbestos is a potential public health hazard, exposure should be eliminated wherever possible.

Section 2(b)(5): As noted earlier, we feel that even asbestos-containing materials that are not now presently damaged should be the subject of concern. These materials in most cases can be expected to release asbestos sometime in the future. Therefore, we suggest that financial assistance be available to provide help for the mitigation of any asbestos hazard which constitutes a significant danger to the health and safety of school children.

Section 3(d)(4): Financial assistance again should not be limited to only materials in advanced stages of disrepair. Many materials that are not in an advanced state of disrepair may, because of their location or asbestos content, constitute a real danger to health and safety.

Section 4(a): Although it is mentioned later in this section, this initial paragraph should mention that the plan will require inspections of schools for the presence of asbestos.

Section 4(a)(1): The timetable should require inspections for the presence of all asbestos in schools, not just imminent asbestos health hazards. As mentioned, presently undamaged asbestos material is likely to be damaged in the future either in the course of routine maintenance or school use. Therefore, the plan should force the identification of all asbestos in schools. Also, the language should be clarified so that it indicates that the inspections themselves, not the procedure for identification, be completed no later than January 1, 1980. Also, the plan should include an estimate of the cost of the inspections.

Section 4(a)(3): The latter half of this paragraph is unclear to us. It requires removal completion by September 1, 1980 but the previous sentence talks about containment and removal. Remedial action in general should be required by a specified date. It is also confusing because the loan program runs for 2 years, yet all hazards it seems must be abated by September 1, 1980. We support, however, the September 1, 1980 date.

Section 4(a)(4): The language used here should clearly require schools to maintain records of all asbestos in their building. Procedures should also be created for notification of workers who may have to contact asbestos-containing material. Also, there should be mandated a periodic follow-up inspection so that areas not damaged at the present time but damaged in the future will be picked up.

Section 4(b): It may be worthwhile to include a specified time for the Secretary's approval of the plan. We do not want delay at the federal level to block the inspections. This section should also require that the results of the survey, indicating the number of schools with asbestos and the type and condition of asbestos in that school, be submitted and changes updated on a regular basis to HEW. Such information should also be available to the public. This reporting system should require the states to indicate what remedial action they have taken.

Section 5(a): There should be specified a time by which the Asbestos Fund will be created and operating. We suggest that, as an attempt to fix the overall size of the Fund, the figure submitted in the state plans for the cost of inspections be used. These figures can be summed for each of the states and therefore serve as the best estimate we have of total cost of inspections. In order to avoid delay in disseminating monies while the plans are being established, an original floor for the Fund can be established. The Fund would then be established based on the information in the plans.

Section 5(b): To prevent legal problems, if it is at all possible to identify through subpoenas the amount of asbestos fiber sold by a company for use in spray material, this should be the basis for determining a company's financial obligation. This would be fairer than a determination based simply on overall fiber production. In addition, perhaps the companies liable should be limited to those that mined or imported asbestos fiber. It is not clear what is meant by "manufacturer of asbestos." It seems unfair to require a company that manufacturered asbestos fireplace ashes, for example, to pay for the hazard caused by asbestos in buildings.

Section 5(b)(3): A section should be included granting the Secretary authority to promulgate regulations as needed relating to the collection of premiums, setting levels of premiums and the overall Fund size.

Section 5(c): As indicated before, we suggest that the Fund pay for 100% of the cost of surveying and testing, and that the revenues for the Fund come from both the asbestos industry and the federal government. It should also be made clear here that school systems that have already paid for inspections can be reimbursed from the Fund. If this is not done, there will be a disincentive created for quick inspections.

Section 5(c)(2)(V): Based on previous testimony of DeKany, Sawyer, and Nicholson before this Committee, air sampling is never needed to determine the likelihood of danger. Their testimony indicated that air sampling is expensive and in most cases unable to give an accurate picture of the hazard. The program should not encourage air sampling.

Section 5(c)(4): Serious consideration should be given to the thought of eliminating the ability of companies to test in lieu of a contribution. Sufficient evidence exists of situations where companies have falsified data to make us wary of such an arrangement.

Section 6(b): We suggest that the percentage of the asbestos material for which removal or containment funds will be available should be very low. We recommend 1% because even this amount can cause a health hazard and it is the cutoff used by EPA in its ban on spraying. There should be an indication of for how many years this loan program will be available. We recommend it be as long term as possible, at least 10 years. The problem will continue to reoccur over this time as more materials are damaged. If the program is extended for this long, the requirements for periodic updating of state plans should also be inserted.

Section 7(b): Sampling as well as sealing, etc. must be done in strict accordance with regulations. Because many public school buildings are not under OSHA's jurisdiction, the task force should be required to establish regulations for sampling, sealing, etc. Also, it is EPA regulations that must be followed on demolition, so EPA should be mentioned in this paragraph.

Section 7(c): We suggest that no child or employee be permitted in the vicinity of a removal or containment activity. The allowance of school authorities to certify no risk of exposure grants too much discretion in a technical area to personnel unable to make those decisions. Because in most cases only a portion of the school will be undergoing remedial action, a prohibition against school children being in the vicinity of that remedial activity should not result in severe problems in the form of total school shutdowns.

Section 10(c): We strongly believe that the term "imminent hazard" must be broadly defined and suggest that in addition to consideration of how friable or easily damaged asbestos-containing materials are, the words "subject to deterioration" be added. The Act would then read:

> "imminent hazard to health and safety"...friable, easily damaged or subject to deterioration, or....

Section 12: There should be a penalty section here to insure that state plans, inspections and remedial actions are completed on schedule. Perhaps the capability to cut off other federal funds for educational purposes should be used.

Respectfully submitted,

Joseph H. Highland
Joseph H. Highland
Chairman
Toxic Chemicals Program

Robert J. Rauch
Robert J. Rauch
Washington Counsel

February 21, 1979

Environmental Defense Fund
1525 18th Street, NW
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STATEMENT OF ROBERT RAUCH ON BEHALF OF DR. JOSEPH H. HIGHLAND, CHAIRMAN, ENVIRONMENTAL DEFENSE FUND

Mr. RAUCH. My name is Robert Rauch, I am a staff attorney with the Environmental Defense Fund, and this morning I am here on behalf of Dr. Joseph Highland, who is the chairman of EDF's toxic chemicals program. Dr. Highland has had some difficulty getting in from a snowed-in subdivision in Gaithersburg. He may be joining us later.

As most of you know, EDF did testify at the hearings that were held by the subcommittee on January 8. I am not going to try and repeat the points we made there, but rather confine my remarks to specific suggestions which we have on the two bills before you.

Also, if there is no objection, I would like to simply submit the statement for the record, which we prepared, and summarize my remarks.

Mr. KOGOVSEK. With no objection, that will be fine.

Mr. RAUCH. First, let me state that EDF is very pleased, as Mr. Smith indicated, that the committee has moved forward promptly. We feel that you have made a very good start, and we do have a number of suggestions we hope will be considered in the markup.

First of all, we are concerned that the bills as presently drafted do not adequately cover the identification of all potential asbestos problems in schools. As Mr. Smith just indicated, there are other sources of asbestos exposure, other than sprayed-on materials.

Furthermore, we are concerned because the definition of "imminent hazard" which is then used to determine which areas have to be inspected is a bit restrictive, in our judgment. We feel that the inspection program should be designed to cover all imminent as well as potential asbestos hazards within the building. If you are going to go through it once there is not much point in not finding everything that is there that may be of hazard. There is little sense, it seems to us, of having to go back again at some point in the future.

So, we suggest that the section which defines what has to be identified in the inspection program be broadened to cover all of the potential as well as imminent hazards.

The second specific concern we have is that as presently drafted neither bill really requires that States either go forward with an inspection program, or that they go forward with the cleanup and removal of the problem. There is, of course, funding made available. There is a requirement that the States identify in a plan what should be done, but we are concerned about the problem of actually enforcing it. Merely making available 50 percent of the necessary moneys—whether they come from the industry of from the Federal Government—we feel may not be a sufficient incentive in certain cases to make certain that the States do the job.

What we would suggest—and we have marked up, essentially, a bill of our own which we will be happy to supply to the subcommittee for its markup—what we suggest is that EPA be directed under its existing authority in the Toxic Substances Control Act to require that inspection be carried out in all areas. What this would do, essentially, it would leave the principal regulatory responsibility, seeing that the job is done, with the Environmental Protection Agency. That would also make sure that some form of financial assistance is available to the States if they are trying to address this problem.

We are also concerned—and I will highlight this a bit more later—that the legislation is not quite as strong as it could be in terms of directing EPA to move forward with its present efforts, particularly these efforts which we requested in our petition to the Administrator for action under section 6.

The bills do, of course, retain the right of the agency to move forward, but we would like to see something a bit more specific, directing them to move forward.

So, in short, we feel that some type of enforcement mechanism, whether it be in this bill directly, or in the form of directing EPA to use its existing authority, should be incorporated.

Third, I would like to talk about the fund which has been set up for paying for inspections. Now, we have two proposals before us, Mr. Miller's—which we favor—which would require that the asbestos manufacturers make contributions to a fund which would be available to pay 50 percent of the costs of inspection.

We also, of course, have Mr. Perkins' bill, which would again provide for 50-percent reimbursement—in some cases slightly more. But those funds would come from the Federal Treasury.

Now, this morning you heard the Deputy Assistant Secretary for Legislation from HEW indicate that the Administration does not support the enactment of this legislation because of budgetary contraints. Needless to say, this is of considerable concern to EDF, and we are very disappointed in this position, particularly in view of Secretary Califano's repeated statements to the public media regarding the seriousness of the problem.

What we would like to suggest is a compromise between the two proposals, that would incorporate what we feel to be in the best elements of each.

We suggest that a fund be created which would be available to totally reimburse the schools for their costs of inspection, 50 percent of which would be provided from contributions by the asbestos manufacturers; and 50 percent of which would come from the Federal Treasury.

Now, the advantage of this, as we see it, is twofold. First, legislation which relies solely on moneys to be supplied by the asbestos industry is undoubtedly going to be litigated—unfortunately. Our contracts with the industry suggest to us that the industry will spare little expense in challenging such legislation. That does not mean that it should not be attempted. We feel very strongly that the asbestos industry should be responsible for paying at least a portion of these costs.

However, the proposal which EDF is making would assure that at least 50 percent of the money which was available would become available immediately through the Federal Government. If the industry did successfully challenge or delay payment of its one-half share, the school districts would still be assured of receiving 50 percent of the needed inspection funds immediately.

On this point I would like to emphasize again, we agree with Mr. Smith, that the legislation should very clearly reflect the intent to reimburse school districts who have already expended money up to the time this legislation is enacted. The reason we support that is not simply to help systems such as New York City's, but to make certain that if this legislation is delayed, that school districts which have not done anything yet, or which have done very little, will not have a disincentive to not move forward. So, we think it is very important that this provision be included so that those systems which are anxious to go forward now and are willing to move forward now, do so with the expectation of later getting reimbursement.

Now I would like to address the bill's provisions for paying for the cleanup of the problem. Both bills set up loan programs to aid schools if repair work is deemed necessary. However, once again, the loans are limited for correcting situations which in the judgment of the Secretary pose an imminent hazard to human health.

What we would suggest here is a two-part program for control. First we would suggest that cleaning up the imminent hazards be funded by grants which would come out of the Federal Treasury, but subject to efforts to gain reimbursement—which I will go into in a moment. Potential hazards—those which are not deemed to be imminent but which may create a problem in the future—would be subject to loan moneys.

So, essentially we would have a grant and loan program combined for control efforts. The grants going towards cleaning up the most immediate hazards, the loans going toward cleaning up potential future hazards.

In this regard we also suggest the legislation contain a specific directive to the Environmental Protection Agency to use whatever authority it has under section 6 of the Toxic Substances Control Act, or other legislation, such as the Clean Air Act, to get reimbursements from the asbestos manufacturers to pay for any Federal moneys which are expended in terms of grants or loans for cleanup efforts.

Mr. Chairman, I am very concerned that the Environmental Protection Agency is just sitting back, waiting. We have seen this happen already with the Consumer Product Safety Commission when the Congress became interested in the problems that cellulose insulation posed a fire hazard. There is a great temptation for an administrative agency to say, "Well, Congress is handling this problem, let us just sit back and see what happens."

Now, obviously EDF has somewhat of a parochial interest here and we are anxious to see the Government move forward on a petition which we have filed. But we also feel that that petition represents the key to not only making sure that the job is done, but also to getting reimbursement from the manufacturers in order to reduce the drain on the Federal Treasury.

I would suggest to you that getting these reimbursements is particularly important given what you heard the Deputy Assistant Secretary from HEW indicate about the budget, and what we all know about the current effects of inflation on the Federal Government.

Let me just stress again that in EDF's judgment the American taxpayer should not have to pay for the bulk of this problem. The American taxpayer did not create the problem. The problem was created by a group of companies which had the knowledge—and we have had some very detailed information that has been developed as a result of litigation, which we believe establishes conclusively that the asbestos manufacturers knew by 1954 at the latest, and that is being very charitable, that asbestos could cause lung cancer, and furthermore, that there is no threshold. This evidence that has been procured through a series of discovery actions in litigation strongly suggests to us that the manufacturers should be held liable for at least that portion of the cost incurred as a result of the use of asbestos from 1954 onward.

Again I would stress that a failure to do this will not only reduce the bill's chances of passage in the Congress, but we feel would also create a very dangerous precedent to suggest that the Federal Government will pay whenever a company has filed to avoid hazards. We do not feel that principle should be established. As many of you know, we went all the way to the President asking him to veto the tris indemnity legislation on this very principle. We feel this principle is important. It has a very important preventive effect, prophylactic effect on future activities, and it also has a very important effect in terms of the passage of this legislation.

So, again, whatever comes out, we suggest a system be created where Federal money will come, and come quickly because we expect the litigation. But, let us make sure that EPA and other agencies that may have authority are directed specifically to take whatever action is possible to recover these moneys.

Let me just say parenthetically that recovery under TOSCA in our judgment is probably the best avenue. We have done some research into the tort law and I will just say that establishing tort recovery claims in the courts in common-law actions is going to be difficult. So, if we are going to have money returned to the Federal Government the best way we see, presently, is to use the existing legislative authority in section 6(a)(7) if the Toxic Substances Control Act.

We also have a number of fairly minor but specific comments on the two bills, which I will not go into detail unless there is interest at this time. We will be providing the subcommittee with a detailed marked-up version of Mr. Miller's bill for use in your markup, which incorporates the suggestions I have made, as well as some specific comments in our testimony.

At this time I would be happy to answer any questions the subcommittee may have. Thank you.

Chairman PERKINS [presiding]. Let me ask you a question. I was not here to hear all of your testimony, but do you believe that we should tax the asbestos industry in order to pay for the legislation?

Mr. RAUCH. We believe, Chairman Perkins, that the Federal Government should put up money in the short term to pay for this because we are convinced that relying exclusively on taxes or other payments by the asbestos manufacturers, it will get litigated and delay the program. But we do believe, yes, that the asbestos industry should pay for at least a portion of these costs. But, as we said earlier, we are not at the point where we rely exclusively—as Mr. Miller's bill does now—on setting up that fund because I know the industry well enough that they are going to litigate. I think they would have to attack on constitutional grounds, which is difficult in Federal courts, but they still would have room for attack, and they might get a stay.

Chairman PERKINS. Well, could we avoid the delays in court by providing that the Federal Government make funds available first, then, after the funds have been expended, the Federal Government will be entitled to reimbursement from the companies. Then, that will leave that question open and will not hamstring early operation of the act, if we see fit to pass it here. Am I correct in that?

Mr. RAUCH. Well, what you are suggesting is that you would legislatively provide that the Federal Government shall be reimbursed at some later date?

I think that is a good suggestion, the only thing I am worried about is, there have to be some grounds established for the reimbursement. What I am suggesting is that section 6 of TOSCA now has a detailed provision which explains how the Federal Government can recover those moneys.

I am just afraid the industry would come in and say, "You have told us to reimburse by legislative fiat without laying out any case as to why we should reimburse."

Chairman PERKINS. Well, we could submit the proof that the manufacturers knew there were dangers in asbestos. You mentioned that in your testimony.

Mr. RAUCH. Yes, you could incorporate that.

Chairman **Perkins**. That has been submitted for the record?

Mr. **Rauch**. It has not been submitted yet.

Chairman **Perkins**. You would submit that for the record?

Mr. **Rauch**. We will try to. Let me put it this way, the lawyers who are working on this case have furnished us with this information. They have not authorized its release yet. We would obviously work together.

Chairman **Perkins**. You will send that in to me in order that I may get it in the record.

Mr. **Rauch**. Yes, we will.

Chairman **Perkins**. Thank you very much. Mr. Kildee?

Mr. **Kildee**. No questions, Mr. Chairman.

Chairman **Perkins**. Mr. Miller?

Mr. **Miller**. Thank you, Mr. Chairman.

As I understand your testimony, you are suggesting that the efforts to recapture the fund from the industry would apply both to the detection section and to the loan fund.

Mr. **Rauch**. That is correct.

Mr. **Miller**. So that in the case of expenditures of public moneys, whether they eventually are local funds or whether they are Federal funds, for detection, the Attorney General should proceed.

Mr. **Rauch**. Yes, sir.

Mr. **Miller**. Thank you.

Chairman **Perkins**. Are there any further questions?

Mr. **Miller**. No, Mr. Chairman.

Chairman **Perkins**. Mr. Buchanan?

Mr. **Buchanan**. Mr. Chairman, I have no questions. I will, in a few moments, seek recognition to submit some testimony.

Chairman **Perkins**. Mr. Erdahl?

Mr. **Erdahl**. Thank you, Mr. Chairman.

I have just one question, sir. It is my understanding from the gentleman who preceded you, Mr. Smith, that for the estimate in New York City they talked about $35 million. Maybe this question should be directed at one of the authors of the bill and not at you, but since you are here, I will ask you.

What would you estimate it would cost, first of all, for the inspection; and second, for the remedy, or the containment over this whole country? Would you care to give a guess or an estimate?

Mr. **Rauch**. We have made some very rough estimates through our discussions with the asbestos manufacturers, at least as to the inspection costs. Those estimates are in the range of $30 to $40 million, just to do the inspection. Now, the actual cost of repair is very difficult to estimate until you have the surveys because you do not know how much has to be removed.

So, I think it is fair to say that it is going to be quite expensive. This is one of the reasons why we feel so strongly that the bill's passage will be enhanced if there is a very specific directive to seek reimbursement from the industry by whatever means available. In other words, not just say, "The right is retained," but to give a directive that says, "Thou shalt go after this money" because otherwise I am concerned—you heard the testimony of the Assistant Secretary from HEW this morning. If that is the administration's position, I am afraid you are going to have a lot of trouble. I think this is a serious problem and I would like to see action taken as soon as possible. We would also like to see the moneys recovered for the Federal Treasury, if possible.

Mr. **ERDAHL**. Thank you, Mr. Chairman, no further questions.

Chairman **PERKINS**. Thank you very much for your appearance here this morning.

Mr. **RAUCH**. Thank you, Mr. Chairman.

Chairman **PERKINS**. I would like to commend Congressman Miller for his leadership in this area. I might add that we expect to mark up legislation very soon, using Mr. Miller's bill as a basis. I am sure that the comments of the witnesses today on the specific points of these two bills will be most helpful to us in the progress.

Now I am going to recognize our colleague on this committee, Congressman Buchanan. You may proceed in any manner you prefer, Mr. Buchanan.

STATEMENT OF HON. JOHN BUCHANAN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF ALABAMA

Mr. **BUCHANAN**. Thank you, Mr. Chairman.

Yesterday we had three distinguished representatives of my State Board of Education in Alabama who were scheduled to testify, and of course the weather prohibited the meeting of the committee and they were not able to stay. So, I ask, Mr. Chairman, unanimous consent to include in the record the full statement of Dr. James D. Owen, deputy superintendent of education of the State of Alabama.

Chairman **PERKINS**. Without objection.

Mr. **BUCHANAN**. I would like to underline orally two or three suggestions they make. Our State superintendent of education, Dr. Wayne Teague, put together a committee to look into this problem in the schools in Alabama, to do research and to give leadership toward solving it. That committee was comprised of Dr. Teague, the Alabama Department of Health, the Alabama Building Commission, the Montgomery, Ala., County Board of Education, the University of Alabama in Birmingham, and Auburn University.

Dr. Owen's testimony is testimony for this committee, as well as for Dr. Teague. They commend the Asbestos Hazard Control Act of 1979 and indicate we do have a problem. They are still surveying in Alabama to determine the extent of the problem, but they strongly support this legislation and urge its passage.

Dr. Owen did make three suggestions. First of all, the Alabama committee urges that we include in this bill a provision for the removal and replacement of all asbestos materials that may be found in school buildings. They felt that while it might be implied in the language of the legislation, the word "replacement" ought to be included so that it would be plain whatever moneys were available could be used for replacement as well as removal, where replacement was necessary. Where asbestos exists it normally does so for a purpose, and where removal is required, replacement in some way may also be required. So, they wanted that language added in the act and made that suggestion, that the word "replacement" be included.

Second, they ask that on grounds of all the financial problems of State and local educational agencies, that we consider sharing the cost on a 50-percent grant basis and make loans available for the other 50 percent.

Third, they strongly urge that the funds be channeled through State education agencies, which will have responsibilities in any case. That the program be channeled through the State education agency in each State, the local education agencies reporting their expenditures directly to the State agency.

This is the essence of the suggestions in the testimony I have submitted for the record, together with the strong support of Dr. Owen, speaking for Dr. Teague, and for the Alabama committee on this subject.

Chairman PERKINS. Thank you very much, you have been very helpful to the committee, Mr. Buchanan.

Mr. BUCHANAN. Thank you, Mr. Chairman.

[The statement of Dr. James E. Owen, deputy superintendent of education, State of Alabama, follows:]

TESTIMONY TO THE SUBCOMMITTEE ON ELEMENTARY, SECONDARY AND VOCATIONAL EDUCATION

The Honorable Carl D. Perkins, Chairman
U. S. House of Representatives

February 21, 1979

by

James E. Owen
Deputy Superintendent of Education
Alabama Department of Education
Montgomery, Alabama 36130

Mr. Chairman and other members of the Subcommittee, thank you for the privilege of addressing this distinguished group regarding major concerns relating to H. R. 1435 and H. R. 1525, "Asbestos School Hazard Detection and Control Act of 1979." We support these bills. Our remarks represent the major concerns of the Alabama Building Commission, Alabama Department of Health, Alabama Department of Education, Montgomery County Board of Education, University of Alabama in Birmingham, and Auburn University regarding the asbestos problem in our school buildings. Recognizing the magnitude of the problem and the public apprehension it has evoked, our State Superintendent of Education, Dr. Wayne Teague, has formed a committee of representatives from the groups I have named and has charged that committee with responsibility for coordinating the State Department of Education's effort to resolve the problem.

The problem regarding asbestos in schools has been reviewed by these groups at various levels, and this document expresses the views prevalent in Alabama. A survey of the city and county public school systems, junior colleges, technical schools, and private schools in

Alabama indicated an initial figure of 143 buildings with sprayed acoustical ceilings that may contain asbestos. Our opinion is that this figure may be considerably short of the actual number of buildings with sprayed ceilings because of on-site inspections and inquiries have uncovered additional, unreported buildings. The identified 143 buildings do not account for the approximately 20% of the systems surveyed that did not respond.

Using the survey as a basis to begin inspection, the Division of Administrative and Financial Services has, as part of an ongoing investigation, visually examined 30 buildings with sprayed acoustical ceilings. These buildings alone have a flat ceiling area of 575,891 square feet of friable, sprayed acoustical ceilings that are suspected of containing asbestos. This does not include an allowance made for sprayed beams or other sprayed areas that would increase the amount of affected surface area.

Our inspectors have taken samples from the inspected buildings. Those samples are labelled and stored, and we are steadily acquiring more. With funding, we can begin testing immediately. We are presently unable to judge accurately the extent of the problem until funding enables us to test our samples. We suspect, however, that because of the extensive use of sprayed asbestos ceilings between 1950 and 1973, an overwhelming majority of the surveyed ceilings do, in fact, contain asbestos.

We need funds to allow us to collect samples, to test the collected samples, and to replace the ceilings if they are hazardous. We have studied H. R. 1435 and H. R. 1534. We would like to offer our recommendations for strengthening these bills.

We urge each member of the Subcommittee to study these recommendations and give full consideration to each of them. The incorporation of these recommendations will, in our opinion, help alleviate many of the problems involved in the implementation of this legislation.

H. R. 1435 and H. R. 1524

Section 2(a), Purposes and Findings

Paragraph (3)(8)

The latest information received regarding the safe level of asbestos in air for a six to eight hour per day exposure is "that asbestos is a proven carcinogen and that exposure probably increases the risk of asbestos-induced cancer, although the degree of risk from low-level exposure has not been quantitated." We feel any exposure to hazardous material should be completely eliminated.

Section 2(b), Purposes

Throughout the bill the solution to the problems related to asbestos has been discussed in terms of "mitigation," "containment," and "removal." We recommend that the purpose of the bill not only include the containment and/or removal of the asbestos material but also include a reference to the replacement of the ceilings that are removed.

H. R. 1435 and H. R. 1524

Section 3, Task Force

We strongly recommend that members of the task force to be appointed by the Secretary include public and non-public elementary, secondary, and postsecondary educators. It is our feeling that these persons could contribute to the work of the task force and help alleviate any administrative problems that might otherwise occur. We recommend that the language of the Law be changed to include members of the educational community. Many task forces continue to exist simply because there was no time limit established when they were created. Consequently, we urge that this task force be appointed for a specific period of time, perhaps for the duration of the bill.

Section 3(d)

Our experience has indicated that there are sprayed-on acoustical ceilings that contain no asbestos components at all and, therefore, should not cause parents concern. Schools must contend with parents that are crisis-oriented, and educational material that does not give a complete picture may cause parents to become overly concerned about any sprayed-on type acoustical ceilings.

Educational material designed to provide technical assistance is desirable and needed; however, material designed merely to create an awareness concerning the problems of asbestos may not be needed at this time.

H.R. 1435 and H.R. 1524

Section 4 - State Plan

We agree with the position of this Subcommittee that time is of the essence, especially when we are dealing with the health of boys and girls of this nation. Ideally, this health hazard should be removed during the summer months when schools are not ordinarily in session.

The date specified for submission of the state plan is established as September 1, 1979. It should be noted, however, that the state plan must contain information which may not be available by that time. That is, the task force may not be formed until 30 days after enactment of this Act and may not meet for another 30 days, and then the task force may not be able to provide information about the identification and containment or removal of asbestos for another 120 days. All of this amounts to 6 months before the necessary information will be available to the states.

We feel that the state plan should not be required prior to 60 days after information from the task force is made available.

Section 4(a), paragraph 3 requires that a time table for the containment or removal of asbestos hazards be established prior to September 1, 1980; however, authorities on sprayed asbestos have not, as yet, established universally accepted procedures for the containment or removal of the material. We hope that this Act will contain realistic time lines based upon the procedures that may be developed for such

Section 4 - State Plan (continued)

containment or removal. For example, if the methods of containment or removal are easily carried out, then the September 1, 1980, deadline may be appropriate. On the other hand, if these procedures are, as our information suggests, time-consuming and difficult, then this deadline may not be realistic.

Section 5 - Asbestos Hazards Detection (Fund)

Section 5(a)(1) of H.R. 1435 and Section 5(c) of H.R. 1524 provide for payment to local units of government for up to one-half of the cost of surveying and testing school buildings for the inspection of hazardous asbestos material.

In some states, for example Alabama, the surveying and testing of school buildings could best be handled from the state level. States could employ and train inspectors who would go into and inspect school buildings, both public and private, thus ensuring a uniform measure statewide. Therefore, we recommend that the legislation be modified to include state government as a possible recipient of funds for inspection and detection.

Section 5(b) Paragraph 1 of H.R. 1435 and Section 5(c) Paragraph 3 of H.R. 1524 provide for payments over a period of three years following the date of the enactment of the acts. We recommend that this date be changed to provide for payments over a period of three years following the due dates of state plans.

Though the bill allows for up to 20 percentum of the monies of funds to be allocated by the Secretary for educational and technical assistance programs, we feel that 20 percentum is an unnecessarily large proportion of funds. Our opinion is that no more than 5 percentum of these monies should be directed to these programs, with the other 15 percentum going directly to defray the costs of containment or removal of the hazardous materials.

Section 6 - Asbestos Hazard Control Loan Program

Because of "Proposition 13" and its effects, as well as the continued high level of inflation, schools across the nation are in dire financial stress. To cite a specific example, we in Alabama education are under a 6% proration mandate by the Governor because tax funds coming into the Special Education Trust Fund have not increased at the level expected.

We appeal to you, as members of this Subcommittee, to consider paying at least 50% of the cost for containing, removing, and replacing this hazardous asbestos material. Without this financial support from the Federal government, school systems which were unfortunate enough to use asbestos materials are going to find it necessary to cut back on instructional programs. It would indeed be a bitter irony if we had to penalize children educationally in order to ensure their health.

We plead with you to consider sharing the cost with the school systems on a 50:50 basis. With the Federal Government providing a grant to cover 50% of the cost and also providing loan monies to cover the other 50% the states and local units of government would have the resources necessary to alleviate the problem.

Section 7, Safety Procedures

While we do not question the need for 120 days to promulgate and distribute safety standards and procedures, we do feel that until states receive this information they cannot be expected to develop and submit state plans which will specify how they will carry out their responsibilities. (See comments concerning Section 4.)

State and local governments are going to need guidance from the Occupational Safety and Health Administration on how to ensure the safety of persons involved with the removal and disposal of asbestos materials. In addition, we will require assistance in determining what procedures must be followed in disposing of any asbestos materials that may be removed from buildings.

SUMMARY

Please accept our "thank you" for inviting us to share our concerns with you regarding the hazards of asbestos in schools. In addition, may we congratulate you on the leadership exhibited by the Subcommittee in this matter. We support these Bills!

We recommend the following changes to improve H. R. 1435 and H. R. 1524:

1. Section 3, Task Force

   The task force should include representatives of public and nonpublic elementary, secondary, and postsecondary educators. The task force should be appointed for a specified period of time.

2. Section 3(d), Duties of Task Force

   Our efforts should be more remedy oriented rather than awareness oriented.

3. Section 4, State Plans

   Time lines should be more flexible and coordinated with one another.

4. Section 5, Payments from the Fund

   States as well as local governments should be allowed to apply for and receive funds for inspection and detection of asbestos. The period of time for payments should extend three years from the day of submission of State plans. Only 5 percent of the funds should be used by the Secretary for awareness-type activities.

5. Section 6, Loan Program

   The federal government should provide 50 percent of the cost for the removal and replacement of asbestos as well as provide funds for a loan for the other 50 percent of the cost.

6. Section 7, Safety Procedures

   State and local governments need considerable guidance from the Environmental Protection Agency and/or the Occupational Safety and Health Administration in safety procedures for performance around asbestos.

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ATTACHMENT NO. 1

AUBURN UNIVERSITY

AUBURN ALABAMA
36830

Office of the Vice President
for Research

Telephone 826-4784
Area Code 205

February 15, 1979

Dr. Wayne Teague
Superintendent of Education
State Office Building
Montgomery, AL 36130

Dear Wayne:

The problem of asbestos contamination in school buildings is a serious one, and we are pleased to know of the leadership which you are taking in efforts to resolve the problem throughout the state. It is encouraging to learn also of the involvement of the Department of Public Health and Building Commission.

Auburn University will be glad to cooperate in this effort, providing such information and assistance as may be appropriate. Several of our faculty have expertise in areas of chemical contaminants, and we also have excellent laboratory facilities for analytical and experimental work.

After learning of your plan for attacking the problem, I talked with Dr. Robert Glaze, Vice President for Research of the University of Alabama in Birmingham, and he has indicated a willingness to provide appropriate assistance also. As you know, our research universities have developed better coordination in the last few years to address problems with the best resources available, depending on the nature of the problem. It is also possible that Southern Research Institute may have one or more persons who have scientific knowledge and experience in this particular area.

As your plan develops, please let me know more specifically how Auburn University may participate.

Sincerely,

Chester C. Carroll

Chester C. Carroll
Vice President for Research

bcc

cc: Dr. Ira Myers
Mr. Hugh Adams
Dr. Robert Glaze

ATTACHMENT NO. 2

STATE OF ALABAMA
BUILDING COMMISSION
[illegible] SOUTH MCDONOUGH STREET
MONTGOMERY, ALABAMA 36104

GOV. FOB JAMES
CHAIRMAN

HUGH D. ADAMS
DIR. OF TECHNICAL STAFF

W. D. WYATT
DEPUTY DIRECTOR

JOHN R. FARRIS
CHIEF ARCHITECT

W. G. STEVENSON
CHIEF ENGINEER

JAMES R. RAIFORD
SECRETARY

February 15, 1979

Dr. Wayne Teague
State Superintendent of Education
State of Alabama
State Office Building
Montgomery, Alabama

Re: Sprayed Asbestos in Buildings

Dear Mr. Teague:

In view of evidence indicating that the use of sprayed asbestos is a possible health hazard in buildings, this is to advise that the Technical Staff of the State Building Commission is conducting a survey to determine the extent of use of this material in State Universities, Special Schools and certain State Departments. This action has been taken in an effort to supplement and broaden the scope of the survey now being conducted by the State Department of Education with regard to Public Schools, Junior Colleges and Trade Schools.

The results of the above survey will be made available to affected agencies to be considered in conjunction with data obtained by your Department.

We assure you that the Technical Staff of the State Building Commission will be glad to cooperate with your Department, the State Health Department and other involved agencies in any possible way to identify and help correct any defined problems related to the use of sprayed asbestos. For your information, the use of this material is no longer approved by this office.

Very truly yours,

STATE BUILDING COMMISSION

Hugh Adams

Hugh D. Adams, Director
Technical Staff

JRF/sk

ATTACHMENT NO. 3

Montgomery
Public
Schools

P.O. Box 1991
Montgomery, Alabama
36103

BOARD OF EDUCATION MEMBERS
E. Kyle Renfroe, Chairman
Foster F. Goodwin
Dr. Frank Jackson
C. Mac Johnson
Harry A. Spears
Nellie C. Weil
Dr. John H. Winston, Jr.

W. S. GARRETT, Superintendent

February 15, 1979

Dr. Wayne Teague
State Superintendent of Education
Department of Education
State Office Building
Montgomery, Alabama 36130

Dear Dr. Teague:

On Thursday morning, February 15, 1979, Mr. George Harris, our Assistant Superintendent in charge of buildings and grounds, met with a group called together by Dr. James A. Shepherd to discuss the problem of sprayed asbestos in school construction. Agencies represented were the State Department of Education, the State Health Department, the Building Commission, Auburn University, and the Montgomery County Board of Education.

The purpose of this meeting was to plan the scope and content of the testimony to be given before the House Committee on Education and Labor next Wednesday, February 21, 1979, by Dr. James E. Owen, Deputy State Superintendent. At this meeting, Mr. Harris agreed to furnish the results of our survey of the school buildings here in the Montgomery County system in regard to the presence of sprayed acoustical ceilings containing asbestos.

The Montgomery County Public School system has a current enrollment of 35,347 students. These students are housed in 51 school centers located throughout the county.

At your request, we surveyed school centers and found that out of the 51, there were 19 that have sprayed on acoustical ceiling materials. Samples of the ceiling materials were taken and sent to Southern Testing Laboratories, Inc., of Birmingham, Alabama. Of the 19 samples tested, 13 did have some asbestos present. The schools where these samples were taken have a combined enrollment of 11,233. This means that approximately 32% of the total enrollment is exposed to asbestos material in the ceilings of the classrooms, hallways, and libraries.

Your help in bringing the seriousness and extent of this problem before Mr. Carl Perkin's Committee next Wednesday will be greatly appreciated.

Sincerely yours,

W. S. Garrett

W. S. Garrett, Superintendent

WSG/swn

ATTACHMENT NO. 4

State of Alabama
Department of Public Health
State Office Building
Montgomery, Alabama 36130

IRA L. MYERS, M. D.
STATE HEALTH OFFICER

February 16, 1979

Dr. Wayne Teague
State Superintendent of Education
Alabama Department of Education
501 Dexter Avenue
Montgomery, Alabama 36130

Dear Dr. Teague:

On Thursday, February 15, 1979, Mr. Blake Jeffcoat of my staff represented the Alabama Department of Public Health in a meeting with representatives of your department, Auburn University, State Building Commission, and Montgomery County Board of Education. The meeting was held to discuss the asbestos problem as it relates to school buildings.

I want to confirm Mr. Jeffcoat's statement that our department is concerned about this problem and will cooperate fully with the Department of Education and will provide assistance within the constraints of our budget and manpower on the health aspects of this matter. The discussion of asbestos-related problems is on the agenda for the State Board of Health meeting on February 21, 1979. I can assure you that the matter will be discussed at length.

As you know, the State Board of Health has very specific statutory obligations and authorities in the field of public health. If it is determined that asbestos in school buildings is a serious public health hazard, we have no alternative but to require that actions be taken to eliminate or correct the conditions creating the health hazard. The latest information received regarding the safe level of asbestos in air for a six to eight hour per day exposure is "that asbestos is a proven carcinogen and that exposure probably increases the risk of asbestos-induced cancer, although the degree of risk from low-level exposure has not been quantitated."

The use of sprayed asbestos material seems to have been widespread during the 1950's and 1960's. It is our opinion that the magnitude of the problem must first be determined. This includes onsite visits and bulk sample analyses. We have contacted Mr. Tom Joiner, State Geologist, who advised that his agency would provide your department with analyses on a cost basis. This would probably be in the range of $25.00 to $50.00 per sample.

If there is a significant risk to public health and if removal techniques are employed, you can expect an estimated expenditure of approximately $10.00 per square foot. Naturally the actual cost will vary dependent upon many factors such as regulatory controls, availability of competent contractors, and the extent of the contract. Due to the stringent removal regulations imposed by EPA and OSHA, the actual figures will probably be considerably higher.

Our department will keep you informed on any information that we might receive on this matter.

Yours very truly,

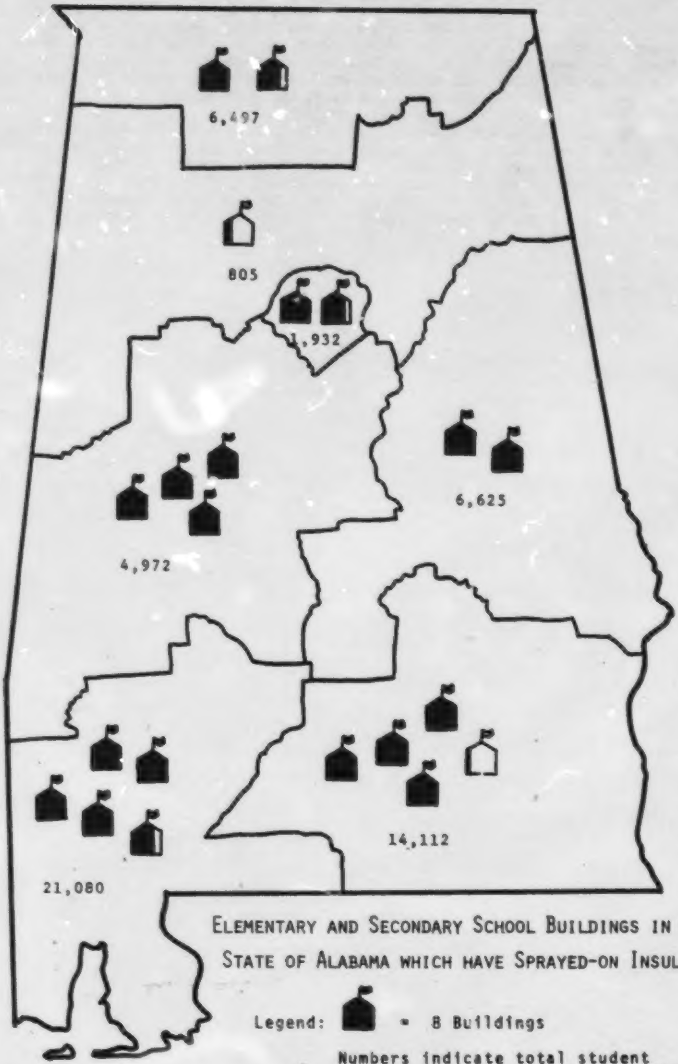
Ira L Myers

Ira L. Myers, M.D.
State Health Officer

ILM/WTW

STATE OF ALABAMA

ATTACHMENT NO. 5


6,497
805
1,932
6,625
4,972
21,080
14,112

ELEMENTARY AND SECONDARY SCHOOL BUILDINGS IN THE STATE OF ALABAMA WHICH HAVE SPRAYED-ON INSULATION

Legend: ● = 8 Buildings

Numbers indicate total student enrollment in the identified buildings.

Chairman **Perkins**. Our next witness is the National School Boards Association executive director, Gus Steinhilber.

Mr. Steinhilber?

[The statement of Mr. Steinhilber follows:]

NSBA
NATIONAL SCHOOL BOARDS ASSOCIATION
1055 Thomas Jefferson Street, N.W., Suite 600, Washington, D.C. 20007/ (202) 337-7666

Testimony on behalf of the

National School Boards Association

on

Asbestos in Schools

before the

Subcommittee on Elementary, Secondary, and Vocational Education

of the
House Committee on Education and Labor
2175 Rayburn House Office Building

Presented by

August W. Steinhilber
Associate Executive Director, Federal Relations
National School Boards Association

February 22, 1979

Mr. Steinhilber is accompanied by:

Michael A. Resnick
Assistant Executive Director
for Legislation
National School Boards Association

Preface

My name is August W. Steinhilber and I am Associate Executive Director for Federal Relations of the National School Boards Association. I am pleased to have this opportunity to testify before the Subcommittee on Elementary, Secondary, and Vocational Education on the subject of asbestos in schools. The National School Boards Association is the only major education organization representing school board members -- who are in some areas called school committee members or school trustees. Throughout the nation, approximately 90,000 of these individuals are Association members. These people, in turn, are responsible for the education of more than ninety-five percent of the nation's public school children.

Currently marking its thirty-ninth year of service, NSBA is a federation of state school boards associations, with direct local school board affiliates, constituted to strengthen local lay control of education and to work for the improvement of education. Most of these school board members are elected public officials. Accordingly, they are politically accountable to their constituents for both education policy and fiscal management. As lay unsalaried individuals, school board members are in a rather unique position of being able to judge legislative programs purely from the standpoint of public education, without consideration to their personal professional interest. My statement today is on behalf of Margaret S. Buvinger, President, and Thomas A. Shannon, Executive Director, of the National School Boards Association. With me today is Michael A. Resnick, Assistant Executive Director for Legislation.

Introduction

I am pleased that the Subcommittee has asked the National School Boards Association to testify again on the hazards of asbestos in schools. NSBA is very much concerned about the possible dangers posed by asbestos to the health of children and employees of our nation's schools. As the Subcommittee undoubtedly knows, NSBA's publication, the American School Board Journal, published a breakthrough article which began to alert school board members, educators, and other policy makers to the asbestos problem.

NSBA appreciates the efforts by members of this Subcommittee to focus Congressional and media attention on this hazard. We view the bills introduced by Chairman Perkins and Congressman Miller as important first steps in eliminating asbestos contamination in the schools.* However, neither bill, as drafted, presents a program which will effectively attract or reach the range of school districts which need to be involved in this federal effort.

In our testimony today, we will discuss our major areas of concern with the draft legislation. We would also like to present the basic ingredients of what we believe to be a practical federal role to assist school districts in dealing with the asbestos problem.

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*In our comments we will consider the bills together, since they are so similar.

II. H.R. 1524 and H.R. 1435: Major Concerns

A. State Plan: Various State Expertise/Unnecessary Beauracracy

Under both bills, the program would be administered pursuant to a state plan. Although state plans may make sense in dealing with statewide educational policies, their usefulness in a renovation program is far less compelling. As recent testimony before this committee has shown, states vary widely in technological expertise to deal with asbestos removal. Therefore, we question whether a state administrative procedure is the most efficient and least costly manner of helping local school districts in all cases. Moreover, we have seen in several states that there can be some jurisdictional complications within the state bureaucracy - whether the program should be administered through a health unit or through an educational unit. In either case, to be helpful, the state officer would need to understand the processes of both asbestos removal and school management. Apart from making the program administration unnecessarily complicated, NSBA is concerned that the bills make local school district eligibility contingent upon state level participation. While NSBA is not arguing against state involvement, we do believe that the program should be sufficiently flexible to permit direct federal communications with, and funding to, local school districts.

B. Program Mandates: Federalism/Insufficient Federal Funding/ Unworkable Timetable

We are concerned that both bills seem to impose a mandated asbestos removal program on local school districts.* Subsection 4(a)(3), provides that state plans must include a timetable which guarantee removal by September 1, 1980. Unless constitutional rights are involved, we caution against any federal program which mandates the participation of state and local units of government. In addition to the challenge which the legislation poses to the concept of federalism, this bill does not provide an adequate financial commitment by the federal government to support a mandated completion date. Further, to our knowledge meaningful cost surveys have not been done from which the fiscal capacity -- including taxpayer support -- of individual school districts to meet a September 1, 1980 deadline could be determined. Finally, the Committee should also realize that as local school districts would be seeking to meet the asbestos deadline, they are also faced with a June, 1980 deadline to remove architectural barriers for handicapped students -- for which there is no federal assistance.

Furthermore, to the extent that a school district does not have sufficient funding available from operating revenues to pay for the cost of asbestos removal, the school board may have to propose a bond issue.

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*In this regard, whereas H.R. 1524 requires the participation of all states, under H.R. 1435 states have the option of submitting state plans. In either case, there is no provision for enforcement against any school district which doesn't meet the mandated timetable contained in the state plan.

In this regard, the timetable necessary to adopt a bond issue would require 1) approval by the school board, 2) clearance of the prospectus by bond counsel, 3) scheduling the bond election in accordance with state mandated dates, 4) scheduling competitive bidding process, pursuant to mandated notice periods, and 5) the commencement of work. Cutting across the budgetary timetable is the factor that asbestos removal should be done when school is not in session, which means the summer period. Our point is, that since states would be implementing identification procedure for late 1979, school systems requiring bond issues might not be able to do the job until the summer of 1981 -- assuming the bond issue passes*.

In sum, while NSBA supports expeditious asbestos removal, in light of such factors as 1) our federal system, 2) the lack of appropriate cost data, 3) the lack of any federal guarantees for funding, 4) federal and state mandates in other areas, and 5) the timing of bond elections with a summer construction period, we do not feel that we can responsibly endorse a September 1, 1980 deadline for removal.

In addition to the removal mandate of the bill, we are also opposed to a provision within the Statement of Findings that would inject the federal government into the relationship of school employees and employers. Specifically, Clause 6 of the Statement of Purposes provides that the federal government will assure that no employee of any school district will suffer any disciplinary action as a result of calling attention to potential asbestos hazards which may exist in schools. While NSBA certainly supports the spirit of this clause, we do not feel that the federal government should attempt to determine what employee actions are exempt from the chain of command or what employee actions are grievable.

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*For the most part, school districts will target their board elections for November, 1980. In this regard, special bond elections, assuming they can be conducted for this purpose, would involve additional expense.

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C. Asbestos Hazard Detection Fund: Too Little, Too Late

A third area of general concern which NSBA has relates to the operation of the Asbestos Hazard Detection Fund. Under H.R. 1425, [Section 5(b)], the fund is to be financed by contributions made by asbestos producers over a period of three years. In this regard, two points need to be made. First, it would appear that the amount of money which school districts can receive from the fund will be dependent upon the amount of contributions made by the private sector*. Second, in coupling the mandatory asbestos removal date of September 1, 1980 together with the three-year period for financing the asbestos removal fund, it appears that school districts will complete their asbestos detection processes before much of the money is actually paid into the fund. If the federal government is serious about financing an asbestos hazard detection program, it should make grants available to local school districts immediately and then seek federal reimbursement from the private sector.

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*It should be noted that H.R. 1435 provides for detection grants rather than an industry reimbursement plan.

D. Asbestos Hazard Control Loan Program: School District Ineligibility/Not Cost Efficient

Our fourth major area of concern involves the emphasis of the asbestos hazard control loan program. Subsection 6(b) provides that loans will be available only for the mitigation or removal of asbestos which pose an imminent hazard to health and safety of children or employees. While NSBA can support the concept of interest-free loans, we are concerned that many needy school districts will be ineligible for assistance because they a) do not have authority from the taxpayers to enter into debt or b) are otherwise barred from borrowing money from the federal government.

Further, by tying loans to immenent hazards, the program appears to encourage a piecemeal asbestos removal or containment program. School districts should be encouraged to develop a comprehensive approach for conducting removal operations in school buildings, rather than just addressing those portions of buildings which pose a hazard on the date of the loan application. In addition, by setting project eligibility at 2,500 square feet, we are not sure whether the effect might be to eliminate small but needy school districts -- or larger districts with several "small projects".

E. Safety Procedures: OSHA Jurisdiction and Local Certification Inappropriate

NSBA has two objections regarding the section relating to safety procedures. First, Subsection 7(b) provides that the process of sealing, containing, and removing asbestos shall be conducted in strict accordance with regulations and procedures established either by the Occupational Safety and Health Administration (OSHA) or by a special HEW Task Force. To date, the operation of local school districts and other state and local units of government have not been placed under the jurisdiction of OSHA. Again, as in the provision concerning employer/employee relations, we can appreciate the specific objective being sought in the bill, but on philosophical and constitutional grounds, we must object to inclusion of local school districts within the jurisdiction of OSHA.

Second, we are concerned with the provision contained in Section 7 which states that school authorities must certify that there will be no risk of exposure to students or personnel who are placed in the vicinity of any asbestos containment or removal activity. In this regard, local school authorities do not have the technical expertise to categorically certify a risk-free situation. Further, such certification might place local school districts in the position of assuming liability for the actions of persons who are not under their control, or the unauthorized actions of personnel or students who are in their control. Especially if, under subsection 7(b), the federal government is going to promulgate regulations and procedures for the process of asbestos removal, it would appear that as long as a local school districts are acting in accordance with those procedures, perhaps the certification should be made by the federal government or simply eliminated as superfluous.

In summary, our criticism of H.R. 1524 and H.R. 1435 are that they develop inappropriate mandates, create questionable jurisdiction by OSHA, and add an unnecessary layer of bureaucracy.

III. NSBA's Proposal for Asbestos Removal

NSBA feels very strongly that the federal government has a responsibility to aid school districts in containing and removing asbestos material.

The approach which NSBA is proposing attempts to make sure that the plan which Congress approves allows aid to flow to schools quickly, and be distributed to the most needy districts.

A. Dissemination of Information: Environmental Protection Agency (EPA)

The most important first step in controlling asbestos is the publication and dissemination of information to school districts about the hazard. Clearly written, straightforward information and detail about the asbestos problem, and techniques for testing, containment, and removal will allow school districts to determine proper action.

The Environmental Protection Agency staff has developed the expertise to be able to provide school personnel with the material they need to begin the process of self-audit. In its legislation, Congress should direct that agency to disseminate information directly to officials in school districts across the nation.

B. Technical Assistance: Environmental Protection Agency

As a second step, EPA should then be directed to be available to provide technical assistance to states and local school districts as they begin to identify and remove areas of contamination. This assistance should include advice on procedures for determining the extent and seriousness of the hazard, as well as guidance on methods of testing and abatement. This will undoubtedly involve training of EPA personnel to provide service to states and localities. It may also include training of state personnel to be able to augment EPA in this program.

While NSBA believes that states should cooperate with the federal government in dealing with this problem, we think it is unnecessary to structure the program through the states. The current information program which is being directed by EPA is voluntary. Secretary Califano's letter to the governors alerting them to the potential danger from asbestos asks for cooperation by the states. As a result of those efforts, the thirty states which have set up abatement programs will be able to contribute usefully. However, for many states, requirements for state planning and direction may only achieve unnecessary bureaucracy with additional time lags, costs, and inefficiencies. We would hope that EPA and the states in the various regions can work together pooling their resources and rising to the most effective level. That is, we suggest a flexible involvement by states which would allow the states to decide the extent of their role, and enable school districts to choose the most useful source of technical assistance - federal or state.

C. Grant Program

NSBA proposes a two-part program of payments -- but both parts of our proposal make payments for containment and removal.

First, we would propose a long-term loan program, as under H.R. 1435 and H.R. 1524, with school districts eligible to obtain loans for up to 100 percent of the costs of renovation. This program would be available for school districts which have the ability to borrow money immediately to alleviate serious, hazardous situations.

As the Committee undoubtedly is aware, most school districts have the authority to make outlays for equipment and minor renovation from operating revenues. It is very likely that school districts with the most serious asbestos problem cannot meet the high costs of abatement. The loan program will encourage school districts to begin removal operations more quickly than they could if they had to wait for their next budget cycle.

However, there are school districts, which are not able to borrow money from any source, at any rate, unless they have approval of the districts' voters. For localities in this situation we propose that Congress authorize a program of grants which would provide immediate funding. Only districts which fall into this special category would be allowed to apply for this funding.

In awarding these grants, the Secretary should consider certain criteria: 1) those school districts most in need; 2) the concentration of asbestos; 3) the cost of containment or removal; 4) the ability of school districts to pay for the costs.

D. Local Publication of Asbestos Conditions

As a requirement for receipt of funds under the grant or loan programs, Congress should consider imposing the requirement on school districts that they publish in a local newspaper the extent of the asbestos hazard in their particular schools. This would serve several purposes. It alerts the public to the problem which the school district is attempting to alleviate. This notice will undoubtedly move members of the community to action in several spheres. Citizens will hold school district personnel accountable for abatement of the problem. In this regard, they are likely to be supportive of removal activities if the school district receives a grant or loan. If they perceive the seriousness of the situation, they also may be more willing to approve a bond issue or a rise in taxes, if such actions are necessary to pay the costs of renovation.

IV. Jurisdictional Problems

NSBA commends this Committee for its concern about and attempts to alleviate hazards caused by sprayed asbestos in schools. We understand the problems caused by the dual jurisdiction of this Committee and the Committee directly responsible for oversight of EPA programs and the difficulties and potential delays which might grow out of a joint referral of this legislation. We are hopeful that the two House Committees can work together to provide funding to school districts to meet these substantial costs.

V. Conclusion

Again, I would like to commend the Committee for its commitment to providing federal funding for school districts in removing asbestos from their schools. NSBA expects to continue to work with the Committee in developing legislation which can alert school districts to the asbestos problem, instruct them in removal, and help finance the associated costs.

STATEMENT OF AUGUST STEINHILBER, EXECUTIVE DIRECTOR, NATIONAL SCHOOL BOARDS ASSOCIATION, ACCOMPANIED BY MICHAEL A. RESNICK, ASSISTANT EXECUTIVE DIRECTOR FOR LEGISLATION

Mr. STEINHILBER. Mr. Chairman, it is always a delight to be before your committee. I would like to request that my full statement be included in the record; I will try to cut it down better than half in my oral presentation.

Chairman PERKINS. Let me say, we are always delighted to welcome you before this committee, Mr. Steinhilber, because you have been most helpful to the school boards across the country. We always find your ideas very constructive. We are glad to have you here again.

Mr. STEINHILBER. Thank you, Mr. Perkins.

As you well know, the National School Boards Association did testify on this concept before this very subcommittee several weeks ago and are very supportive of legislation on this particular issue.

What we would like to do today is spend some particular time looking at the two bills in question, and the whole question of asbestos. We are very much concerned about the health of children and employees, but we do have some specific concerns with respect to the way the particular legislation has been drafted.

Now, under both bills the program would be administered under a State plan. Although State plans make a great deal of sense when we are talking about educational policies, their usefulness in a renovation program is far less compelling. As recent testimony before this subcommittee has shown, States vary widely in technological expertise in dealing with asbestos removal. Therefore we question whether a State administrative procedure is the most effective and least costly manner of helping local school districts.

Apart from making the program administratively complicated, NSBA is concerned that the bills make local school district eligibility contingent upon State level participation. Query: What happens if the State wishes not to participate?

While NSBA is not arguing against State involvement, we do believe that the program should be sufficiently flexible to permit direct Federal communications with and funding to local school districts.

Our next concern is one that we call program mandates. We are concerned that both bills seem to impose mandated asbestos removal programs on local school districts. Unless constitutional rights are involved—such as in desegregation issues—we caution against any Federal program which mandates the participation of State and local units of government. In addition to the challenge which the legislation poses to the concept of federalism, the bill does not provide an adequate financial commitment by the Federal Government in support of the mandated completion date.

I am going to deviate quite a bit from the testimony in this particular moment in time to go to the point that the date in the bill, September 1, 1980, also happens to be very close to the June 1980 date for architectural barriers for handicapped students under section 504 of the Vocational Rehabilitation Act.

We are seeing a constant mandating of requirements on local school districts without the financial wherewithall to do it. Under Public Law 94-142 at this moment in time we should be talking about an appropriation where 30 percent of the excess cost goes to local school districts. The Administration has asked for 12 percent. Next year it was supposed to be at 40 percent. So, in the final analysis, what is going to happen at the local property taxpayer level is once again, the mandate is going to occur at the Federal level and the local property tax is going to have to be increased to pick up the costs. We are afraid that we are going down that same road again, and we ought to be aware that we are going down that road.

Mr. Miller. Would you yield for a moment on that point?

Mr. Steinhilber. Yes, sir.

Mr. Miller. What is the mandate?

Mr. Steinhilber. Well, the mandates here are that under your bill and Mr. Perkins' bill each State in effect has to come through with a State program of investigation—if you wish me to go to the specific provisions? And that the State in turn must go through a process of identifying a plan which identifies all asbestos in every school.

Mr. Miller. It tells us how they would go about implementing the program of detection or replacement. If they do not want to do it, they do not have to do it. There is no mandate that any local jurisdiction does anything, under this legislation.

Mr. **Steinhilber**. We think we are heading in that particular direction.

Mr. **Miller**. Not with this bill you are not. We do not say you have to remove the asbestos, you can keep it there, if you want.

Mr. **Resnick**. If I can perhaps inject a point of concern we have with respect to the bill.

Mr. **Miller**. Sure.

Mr. **Resnick**. Section 4 deals with the State plan and in part provides that no later than September 1, 1979, each State shall submit State plans to the Secretary. Then, reading through this introductive paragraph, "Such plans shall include," and then, under clause 3:

> A timetable for the expeditious containment or removal of asbestos hazards which have been identified, pursuant to subsection (1) of this section and in accordance with regulations promulgated by the section, provided that such removal shall be completed no later than September 1, 1980.

Mr. **Miller**. Well, that is on the theory that you believe, as we do, that in some cases this problem poses an imminent danger to young children.

Mr. **Resnick**. I don't think the question is, if I may, Mr. Miller, is one of whether there is a danger to children.

Mr. **Miller**. Well, for a lot of people that will be the question. They will decide, if they do not see the danger, that they do not want to get involved in the program. The architectural removal of barriers is so far afield that I do not understand.

Mr. **Resnick**. I think the question that we are trying to raise is this, it is not so much from our standpoint whether we can make a safer environment for schoolchildren, but the question that does arise, how are we able to finance the costs, especially when we have now a concomitant cost of removing architectural barriers for handicapped children.

The question that arises is, Can we find the money within the local tax base to do the job? The school districts have to submit their local budgets to the taxpayer. What if the taxpayer turns it down for the school district that has to go to the bond referendum, what happens if the taxpayer turns the bond issue down?

Mr. **Steinhilber**. To go back to the philosophical base, we are not at all suggesting, nor have we ever suggested, that this is not a problem. In fact, our previous testimony outlines that very particular issue. It is a problem. In fact, we have embarked upon a program of warning school districts on asbestos removal literally 1½ years before the testimony before this committee.

Mr. **Miller**. Well, for 1½ years they have been, at least from your organization, on notice that they have a problem and they ought to consider doing something about it, so that at the end of the year they can figure out how to deal with that solution.

Mr. **Resnick**. I think there in a twofold question. First we see EPA—and we are glad to see it—developing a manual to not just identify and alert school districts to the question, but to technically assist in knowing how to approach the problem.

Second, moving to the question of identification, the concern that Mr. Steinhilber is presenting here in this portion of our testimony is one on the financial side, that, if you are dealing with the construction issue, especially if you have to go the bond-issue route, the question that arises is not whether you can save the money for the job, but how you can get the taxpayer to provide you with the funds. We are concerned we have a cost here, especially in the context of all other mandated costs on school districts, that it is just far beyond our ability to pay.

Mr. **Miller**. I do not see the inconsistency with the legislation. I think these are oral determinations that will have to be made by parents, and local school districts, and local school boards, and local administrators. If they want to take advantage of the legislation, they can do that. If they cannot do that, then they make some other determination.

Mr. **Steinhilber**. Well, as we go into our testimony we are making specific suggestions.

Mr. **Miller**. I understand that.

Mr. **Steinhilber**. We are making suggestions as to how to handle this particular question. I just wanted to bring up an issue that is going to become very, very sensitive around the United States and, quite frankly, particularly in California. As you well know, the California Legislature now on all mandated programs to local school districts is under similar kinds of concerns.

Mr. **Miller**. I know Senate bill 90 very well, but that is why that is not a mandate. That was a sham, see. There they were going to give you all the money, but they never did.

Mr. **Steinhilber**. I would like to point out the process for bonds because we are talking, in loans, in terms of very precise procedures. Whether a school district is borrowing the money from the Federal Government, or whether a school district is borrowing the money on the outside market, we still have to go for the approval of the local board. We have to go to the clearance of a prospectus of bond council. We have to schedule bond elections according to State-mandated procedures. There is a schedule of bidding process, and the work has to be commenced, normally has to be commenced during the summer period of months.

Now, all I am saying here is, a combination of the time schedule which is in this particular piece of legislation, 1980, and for those districts that have to go to bond issues, or have to get at least permission to borrow, they may very well not literally have the time to complete the process before that period of time has expired.

I would like to go into the question that we think the Federal Government should be financing a great deal of, indeed, entirely the whole question of the detection program. It should make grants available to local school districts immediately and seek reimbursement from the private sector, similar to your question, sir, to the previous witness.

Our fourth major concern involves the emphasis on asbestos hazard control loan programs. Loans could be available only for the mitigation or removal of asbestos which imposes an immediate hazard—and I underscore the word "immediate." While NSBA can support the concept of interest-free loans, we are concerned that many needy school districts will be ineligible for assistance because they do not have the authority to go into debt. Furthermore, the question of immediate hazard says, "Are we going to go on a

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piecemeal kind of approach." School districts should be encouraged to develop a comprehensive program for conducting the removal of asbestos in all buildings, not just those particular buildings which are an immediate hazard.

SAFETY PROCEDURES

NSBA has two objectives regarding the section relating to safety procedures. First, under section 7(b) work must be conducted in strict accordance with regulations established by OSHA or by a special HEW task force. Local school districts, like other State and local units of government, are not under the jurisdiction of OSHA. Again, we can appreciate the specific objectives sought by the bill, but on philosophical and constitutional grounds, we must object to the inclusion of local school districts under the jurisdiction of OSHA.

Second, we are concerned with the provisions contained in section 7 which states that school authorities must certify that there will be no risk to students or personnel who are near any asbestos-removal activity. Local school authorities just do not have the technical expertise to certify a risk-free situation. Further, such certification might place local school districts in a position of assuming legal liability for the actions of persons who are not under their control, or by unauthorized actions of personnel or students.

In summary, our criticisms of these bills are that they develop inappropriate mandates, create questionable jurisdiction by OSHA, and add an unnecessary layer of bureaucracy.

NSBS's approach is to make sure that aid flows to schools quickly and is distributed to the most needy districts.

The first most important step in controlling asbestos is in the publication and dissemination of information. Clearly written information about the asbestos problem and techniques for testing, containment, and removal will allow school districts to determine proper action.

EPA has developed the expertise to be able to provide school personnel with the material they need to begin the self-audit in process. Indeed, we have just completed our comments to EPA. We are asking them to do some certain things, and our comments are going to be placed with their particular self-evaluation, self-audit.

However, in the legislation Congress should direct that agency to disseminate this information directly to officials in school districts around the United States. It is one thing to have the material here in Washington; it is another thing to have the material available throughout the United States.

As a second step, EPA should then be directed to be available to provide technical assistance to States and LEA's as they begin to identify and remove areas of contamination. This assistance should include advice on procedures for determining the extent and seriousness of the hazard, as well as guidance on the methods of testing and abatement.

While the NSBA believes that States should cooperate with the Federal Government in dealing with the problem, we think it unnecessary to structure the program absolutely through the States. We would hope the EPA and the States and the various regions can work together by pooling their resources. That is, we would suggest a flexible involvement of States which would allow the States to decide the extent of their role and enable school districts to choose the most useful source of technical assistance—Federal or State.

You recall from previous testimony, right now only 30 States have anything in their State departments of education on this particular issue. So, for the rest we do have the problem that they just do not have the technical expertise.

NSBA proposes a two-part program of payments—both parts of our proposal make payments for containment and removal. I might add, the comment which came through the minority member who just spoke a moment ago makes sense because when we talk about containment and removal, we are also talking about replacement because school districts are still going to be caught by such things as fire codes and things of that sort, that they are going to have to provide insulation in the place of asbestos once the asbestos is removed.

First, we would propose a long-term loan program, as under the two bills which you have before you, with school districts eligible to obtain loans up to 100 percent of the cost of renovation. This program would be available for school districts which have the ability to borrow money immediately to alleviate serious, hazardous situations.

However, there are school districts which are not able to borrow money from any source, at any rate, unless they have approval of the voters. Therefore we propose Congress authorize a program of grants, which would provide immediate funding. Only districts which fall into this special category would be allowed for this kind of funding.

As a requirement for the receipt of funds under the grant or loan programs, Congress should consider imposing the requirement on school districts that they publish in a local newspaper the extent of asbestos hazard in their particular schools. This would serve several purposes. It alerts the public to the problem which the school district is attempting to alleviate. This notice will undoubtedly move members of the community to action in several spheres. Citizens would hold the school district and its personnel accountable for the abatement program.

With respect to the jurisdictional problems of the committee, NSBA comments this committee for its concern about and its attempts to alleviate hazards caused by spraying asbestos in the schools. We understand the problems caused by the dual jurisdiction of this committee and the committee involved with EPA. We are hopeful that the two committees can work together to provide the funding to school districts.

Once again, Mr. Chairman, I commend the committee for its commitment to providing Federal funding for school districts. We will be ready, willing, and able to provide any such technical expertise to you as you proceed, indeed, we would even be so bold to put together the specifications of a bill if you would so wish.

Chairman PERKINS. Let me thank you, Mr. Steinhilber, for your excellent testimony.

As to the extent of the problem, do you have any statistics on the cost of removing the asbestos in the country?

Mr. Steinhilber. There are certain problems with it, as you well know. Asbestos became part of building materials in the period immediately after World War II and proceeded into the 1970's, until EPA determined it to be a hazardous substance.

There is no direct way that we currently know how many buildings have asbestos in them. We do know that the cost of containment is running between $8 and $12 a square foot—containment alone. Where we talk about removal of asbestos, we know that the figures start at $15 a square foot and run thereon. I will ask Mr. Resnick if he has any other comments with respect to the cost.

Mr. Resnick. I do not with respect to the cost, but in the proposed draft manual that EPA has, they too are concerned about developing data as to the extent of the problem. In fact, they are suggesting a voluntary program for local school districts to submit information as to the extent of the problem that exists across the country in the schools. It would appear that they are targeting for early next year for the reporting of the data that accumulated.

So, we will probably have a much clearer idea through EPA, at least, as to what the extent of the problem is, by next year.

Chairman Perkins. I think that we ought to be as realistic as possible and come up with the best figure that we possibly can as to the cost, because that is going to be the big argument against the legislation on the floor, in my judgment. The sooner we can get some concrete evidence along this line, the sooner we will be able to move.

I would like to see us move at an early date and see where we go. Take it up with the full committee and see what we can accomplish in this area.

Do you have any further questions, Mr. Kildee?

Mr. Kildee. No questions.

Chairman Perkins. Mr. Miller?

Mr. Miller. No questions.

Chairman Perkins. Thank you very much, Mr. Steinhilber, for your appearance here today.

The committee will now recess, subject to the call of the Chair.

[Whereupon, at 11:15 a.m., the subcommittee adjourned, to reconvene subject to the call of the Chair.]

[Material submitted for inclusion in the record follows:]

Johns-Manville Corporation

Suite 214
1025 Connecticut Avenue, N.W.
Washington, D.C. 20036
202 785-4940

Executive Offices

February 20, 1979

Hon. Carl D. Perkins
Chairman, House Committee on Education & Labor
2181 Rayburn House Office Building
Washington, DC

Dear Chairman Perkins:

Enclosed for your information is a letter from John A. McKinney, Chairman and Chief Executive Officer of the Johns-Manville Corporation commenting on your bill (H.R. 1435).

I am requesting that you include his comments into the record of your hearings scheduled for February 21, 1979.

Very truly yours,

John S. Autry
Vice President and
Director of Public Affairs

JSA:jam

enclosure: letter

Johns-Manville Corporation

Ken-Caryl Ranch
Denver, Colorado 80217

J. A. McKinney
President and
Chief Executive Officer

February 20, 1979

Hon. Carl D. Perkins
Chairman, House Committee on Education & Labor
2181 Rayburn House Office Building
Washington, DC

Dear Chairman Perkins:

In recent months there has been extensive and legitimate concern, controversy and publicity over the presence of sprayed insulation materials containing asbestos in school buildings. H.R. 1435, which you have introduced in the 96th Congress, is a reasonable attempt to deal with this situation.

This use of asbestos was developed by others and Johns-Manville has never commercially marketed such a product. Nevertheless, Johns-Manville does possess expertise in this area which we would like to make available to the Committee.

As you are well aware there is medical and scientific disagreement on the existence in some schools of a possible health hazard from sprayed insulation materials containing asbestos. However, it is clear that regardless of the actual existence of a health hazard actions are being taken by local school districts and are in many instances without a proper technical and scientific basis. Johns-Manville continues to endorse programs which will evaluate asbestos exposures and provide accurate technical information.

A well conceived program will avoid unnecessary actions and expenditures and the risk of creating hazardous exposures where none now exist. Such a program will first ascertain the presence of sprayed insulation materials containing asbestos and exposures from such materials prior to considering possible corrective measures.

It is patent that the existence of asbestos in building materials does not ordain harmful exposure to respirable asbestos fiber. Exposure in schools or elsewhere to asbestos fiber deriving from sprayed insulation materials have not approached the levels deemed acceptable by OSHA for occupational exposures. The limited exposures in schools are more consistent with environmental exposures encountered by people residing near asbestos manufacturing plants such as studied by Dr. Selikoff in Patterson, New Jersey, and reported at the June 1978 meeting of the New York Academy of Sciences. That study concluded the people who lived in the immediate vicinity of the plant were at no increased risk to asbestos related disease. The study and its conclusions merit the thoughtful consideration of your Committee in evaluating the immediacy and severity of the hazard posited by certain advocates.

As Dr. J. P. Laineweber indicated in his testimony before the Subcommittee on Elementary, Secondary, and Vocational Education on January 8, 1979, Johns-Manville has cooperated and worked with EPA in exploring the sprayed insulation situation in the nation's schools, and in the EPA's preparation of a voluntary action program to provide school districts with technical and analytical assistance in dealing with sprayed insulation materials. In large measure we view H.R. 1435 as the legislative counterpart to these efforts to establish a scientific, analytical and technically sound basis for investigation and action, as recognized in Section 2 (a) of the bill.

Consistent with our support of EPA's activities in this area we view H.R. 1435 as an appropriate method of supplying the nation's school districts with scientific and technical information and assistance on a voluntary basis.

One cannot and should not attempt to mandate on a subject where there exists honest and well founded differences as to the very existence of a possible hazard, and appropriate responses to the presence of sprayed insulation materials containing asbestos in school buildings. However, no one can object to continued scientific inquiry in this area. Consistent with our commitment to the truth about asbestos we can support your efforts to provide for freedom of choice and voluntary action as may be deemed adequate and appropriate by local school districts based upon adequate scientific and technical information.

My staff has developed detailed comments and suggestions relative to specific sections of the Bill, and I attach these for your reference.

I trust our observations and comments will prove helpful in your consideration of this highly emotional issue.

Sincerely,

J A McKinney
John A. McKinney
Chairman of the Board

cc: see attached
encl: comments

COMMENTS
H.R. 1435

1. Section 2 (a)(1) - The clause "over a long period of time" is non-specific, confusing, and unnecessary to the intent of the Bill. In the same section the phrase "incidence of cancer" is overly broad. We would suggest adding the words "certain types" before the word "cancer".

2. Section 2 (a)(3) - We do not believe this section as phrased accurately represents the state of medical and scientific opinion on the subject of a threshold limit values. In fact, there is difference of agreement on the existence of a treshold, the level at which such a threshold exists, and the possibility of different thresholds for different biological reactions. The Occupational Safety & Health Administration has, in fact, established a treshold for occupational exposures to asbestos. This section could be deleted without adversely affecting the Bill. At the very least it should be reworded to more accurately reflect the state of the medical and scientific art.

3. Section 2 (a)(7) - In as much as H.R. 1435 calls for a voluntary program there is no necessity for the word "mandatory" on line 6.

4. Section 2 (a) (7)(9)(10) - In view of the overall scientific testimony presented to the Subcommittee on January 9, 1979 and the differences as to the existence of a hazard we submit that the word "hazardous" as it appears in this and other sections of the Bill be qualified by the word "possibly".

5. Section 2 (b)(1) - The clause "to ascertain the extent of the danger to the health of school children and employees of asbestos materials in the schools" appearing on lines 22-25 presumes that a danger does in fact exist, and that the only unknown element is the extent of the danger. In fact, there is disagreement as to the existence of any danger, and in any event, all will concede that there are situations where sprayed asbestos materials exist in school buildings but present no conceivable hazard by any standard or criteria. Accordingly, we suggest that on lines 22 and 23 the language be changed to read "to ascertain whether there exists a danger to the health of school children and employees due to the presence of asbestos containing materials in the schools".

6. Section 2 (b)(2) - Consistent with earlier comments we suggest that the word "possibly" be added to line 4 before the word "hazardous".

COMMENTS
p.2

7. Section 3(a) - The language appearing on lines 4 and 5 on page 5 should be broadened so as to permit representation by private organizations, companies, and corporations concerned with education and health and possessing technical and scientific knowledge relating to asbestos.

8. Section 3 (a)(4) - The term "imminent danger to the health and safety " is inconsistent with definition in Section 10(4) where the term is, "imminent hazard to the health and safety". Either terminology is inappropriate and unsupported by the evidence. Consistent with the evidence which has been presented to the Subcommittee and to avoid inappropriate inferences we would suggest that the term "imminent hazard to the health and safety" be changed to read "possible hazard to the health and safety". Such terminology would be consistent with the medical and scientific evidence and would not adversely affect the import of the Bill. This same comment would apply to the other sections throughout H.R. 1435 wherein the term "imminent danger" is used.

9. Section 4 (a) - Consistent with Dr. Leineweber's testimony of January 9, 1979 we would suggest that the words "deemed necessary" as appearing on line 25 and line 1 on page 7 be changed to "recommended or advised".

10. Section 5 (a)(1) - Consistent with previous comments we would suggest the deletion of the words "whether hazardous" appearing on line 12. The purpose of the surveying and testing would be to determine actual concentrations of asbestos fiber from which a judgment could then be made as to the advisability of containment or removal pursuant to Section 4 (a).

11. Section 10(4) - See comments on Section 3 (a)(4).

12. Finally, an issue for consideration. Data to date indicates that most schools contain no sprayed asbestos containing materials. Accordingly, testing where none is called for is to be avoided. Will the Bill as presently drafted provide for a pre-screening process to first determine the presence of asbestos containing materials in school buildings? An effective pre-screening program such as conducted by the State of Michigan will avoid inordinate amount of time and money being expanded in doing formal air sampling and testing in schools where asbestos containing materials are not present.

Johns-Manville Corporation
February 1979

STATE OF NEW JERSEY
WASHINGTON OFFICE

BRENDAN T. BYRNE
GOVERNOR

444 NORTH CAPITOL STREET, N.W.
WASHINGTON, D.C. 20001
202-638-0631

March 5, 1979

The Honorable Carl Perkins
Chairman, Elementary, Secondary
& Vocational Education Sub-
committee
B-346 C Rayburn House Office Building
Washington, D. C. 20515

Dear Congressman Perkins:

I am writing to express the interest of the State of New Jersey in the asbestos legislation which the Elementary, Secondary and Vocational Education Subcommittee will mark up this Wednesday, March 7. It should first be said that the Subcommittee's work on this issue is welcome news, and the leadership by the Subcommittee and its Chairman is much appreciated. State personnel have been very active on the issue of asbestos in schools since Governor Byrne first established a State Task Force in February 1977.

The bills to be considered (H.R. 1435 and H.R. 1524) by you on Wednesday were examined by the New Jersey Departments of Education, Health and Environmental Protection. While the State supports the legislation and your efforts, I would like to relay to you some suggestions, from the State's viewpoint, for your consideration.

> In Section 3, we recommend that a representative of the National Institute of Occupational Safety and Health (NIOSH) be placed on the Task Force since the hazards extend to staff as well as students. In addition, the function of the Task Force should be expanded to include the development of a model State plan which would, in effect, provide states with an example which could be adopted, or adapted, by the states, while establishing some minimum standards for such plans.
>
> In Section 4, the State Plan, which each state must develop, refers to "all schools situated within the State." The phrase "all schools" poses a problem because state agencies do not have jurisdiction over private schools, however, private schools could request the assistance of the state in dealing with asbestos. The bill should be amended to provide for this situation.
>
> While the timetable for development of the State Plan is generally reasonable, we do not believe that it is feasible to expect that removal can be completed by September 1, 1980.

March 5, 1979
- 2 -

In light of the uncertainties concerning the availability of funding, there should not be a specific deadline for removal. Furthermore, the word "removal" is inappropriate because it precludes other remedial action.

Finally, the State Plan should also include a timetable for the identification and quality control of both laboratory facilities for identification and contractors capable of performing remedial work.

In Sections 5 and 6, it may be practical to meld the provisions of both H.R. 1435 and H.R. 1524. The latter legislation establishes an Asbestos Hazards Detection Fund to be funded by asbestos companies. This is a commendable concept, but an alternative method of funding (by general appropriation as in H.R. 1435) should be authorized in the event that problems are encountered in receiving payments from these companies because they are no longer in business or because they contest their obligation.

In addition, we would also prefer to see such a fund used for remedial action, which is far more costly, than for detection, which cost could be absorbed by the local and/or state government.

In Section 6, as stated in the above paragraph, grants from the fund/appropriation, should be used for remedial action. As commendable as the no-interest loan program is, the burden of raising the necessary funds still remains with the local and/or state government. Remedial action is by far the more costly of the detection and remedy process. Grants, instead of loans, on a 75% federal/25% state or local matching basis would be the meaningful way to encourage school districts to take remedial actions.

In Section 10, operative words in the Act are defined. We believe that the definition of "asbestos materials" should be limited to sprayed-on surface coatings containing at least 1% by weight asbestos. To define the term to include any substance composed entirely or in part of asbestos would include the use of asbestos in many apparently non-hazardous circumstances and would be too broad.

Your consideration of the above comments would be appreciated. Any questions that you and your staff may have on the suggestions or on this issue will be promptly answered.

Sincerely,

Paul H. Bea
Assistant to the Governor

Barry I. Castleman,
Environmental Consultant,
Knoxville, Md., March 2, 1979.
Hon. Carl D. Perkins,
Chairman, House Committee on Education and Labor,
Washington, D.C.

Dear Mr. Perkins: I have worked on various environmental asbestos problems and am presently a consultant to the Environmental Protection Agency. I also provide expert testimony and research to victims of asbestos disease who are suing manufacturers for product liability.

The enclosed remarks are about asbestos in school buildings, a matter of widespread concern currently before your Committee. My comments on the subjects of risk and industry responsibility are offered for the record of your hearings, in the hope that they may be of use to the Committee.

Respectfully,

Barry I. Castleman.

Asbestos Hazards in Schools

I. RISK

The hazard of asbestos ceilings in schools and other buildings has been recognized and in some cases corrected in this country, Great Britain, and France. The "Conseil Superieur d'Hygiene Publique de France" has proposed an ambient asbestos limit of 50 nanograms asbestos per cubic meter of air inside buildings with asbestos ceilings. This level of airborne asbestos was also found downwind of buildings in New York where asbestos spraying took place in 1971, shortly before the use of sprayed asbestos was virtually eliminated by the EPA. In England, the House of Commons has recently undergone renovation for the removal of asbestos in the roof space of the House of Commons Chamber and the linings of ventilation ducts of the House complex. There have been a number of American school buildings where asbestos surface coatings were stripped off and removed, starting at least as far back as 1971 (e.g., an elementary school in Lander, Wyoming; UCLA dormitories; Yale's architecture building).

The threat from deterioration in buildings with asbestos surfaces, especially surfaces that are subject to physical impact, has thus been recognized for some time. Dr. Robert Sawyer at Yale has written extensively on the nature of the problem and how to deal with it. The hazard may manifest itself at first as skin reactions and respiratory symptoms; however, the main concern is the risk of developing cancer, many years (20-50) after the onset of exposure to asbestos.

No one knows how much risk a child has of getting cancer from spending a year in a school with, let us say, 50 nanograms per cubic meter of asbestos, in the air. It is unlikely that we will be able to make reliable estimates of that risk in the near future. What we do know is that asbestos is a human carcinogen, and despite the voluminous medical literature on it there is no scientific evidence of the existence of a safe threshold for human exposure to asbestos. Rare asbestos cancer (mesothelioma of the pleura) have been shown to strike a wide range of people with only "bystander" exposure to asbestos; neighbors of asbestos plants and shipyards, relatives in households of asbestos workers, and non-asbestos workers in all the shipyard and construction trades. This information was substantially developed in the years 1960-1965.

One of the people I work for, Mrs. Frances Harig of Baltimore, worked in a plant where Johns-Manville asbestos panels were sawed up—but she was not running the saw; she worked two floors below as a secretary, and now she has mesothelioma. Another woman with mesothelioma spent 1½ years on an hour-a-day stint pushing a coffee cart through an asbestos plant. It isn't possible to go back 30 years and measure the exposures that produced mesothelioma, but there is every reason to assume a danger exists for children in schools with deteriorating asbestos surfaces. We can't even say for sure that buildings with no apparent deterioration are safe.

Mesothelioma is not the only cancer caused by asbestos, though its distinctiveness allows for the identification of "bystander" victims. One out of 5 asbestos insulation workers dies from lung cancer, most of them smokers. Studies of these workers have shown that the combined lung cancer risk in men who smoke and work with asbestos is 92 times as high as in men who do neither. Smokers have only about 10 times the lung cancer risk of non-smokers, by comparison. The "multiplier effect" of asbestos in smaller doses has not been studied—but there is reason for concern about school children and other who are exposed to asbestos and who also smoke (or later become smokers).

Asbestos also causes cancer of the larynx, esophagus, stomach, bowel, colon, and kidneys in asbestos workers. The millions of us with lesser exposure to asbestos may also be afflicted by these deseases, some of which are caused and "promoted" by other, added carcinogenic insults in our diet, our work, consumer products, medications, and so on.

Since the mid-1950's, there has been a general consensus of scientific opinion to the effect that any exposure to a carcinogen must be presumed to carry some cancer risk. That is to say, there are no "safe thresholds" of exposure (besides zero) to a carcinogen. A carcinogen need only trigger the formation of one malignant cell to pose the threat of a cancerous growth. This no-threshold concept of carcinogenesis is one of the most unanimously held theories in biological science today.

II. INDUSTRY RESPONSIBILITY

As Congressman Miller has proposed to have the asbestos industry help pay for the cost of sampling and analysis of asbestos in schools, it is important to evaluate the historical conduct of the industry in fairness to both industry and the taxpayers.

The no-threshold concept of carcinogenesis was expressed in the works of Dr. Wilhelm Heuper, the most eminent environmental cancer scientist this country has produced. Heuper implored industry to substitute carcinogens used in the workplace and specifically named asbestos as a carcinogen in 1943. That same year, lung cancer was formally declared a compensable occupational disease among asbestos workers in Germany. In 1952, an international panel of scientists declared that a lung cancer risk had been "demonstrated" in, among other things, "the handling of asbestos." Around that time, employees confronted Johns-Manville and Armstrong Cork with workers' compensation claims for lung cancer.

Industry recognized that there was an air pollution threat from its operations long ago. In 1949, a survey of a Johns-Manville mill led to an internal request for funds for control of air pollution emissions.

In a 1955 Public Health Service Monograph, Dr. Hueper warned that the general population was endangered by carcinogenic air pollutants, including asbestos. As usual, Hueper called for development of substitute products for industrially used carcinogens. Dr. Thomas Mancuso was hired by another U.S. asbestos company with asbestos mines in Canada, Philip Carey Corporation, in 1962. Mancuso urged control of air pollution, informing officers of the company that they might face lawsuits from neighbors of their asbestos plants for cancer. From descriptions of many asbestos manufacturing operations of those years, it must have been clear that the airborne cancer hazard did not end at the factory gates.

Asbestos pollution of ambient air from factory emissions is in many respects a similar threat to indoor air pollution from deteriorating asbestos ceilings.

Representatives of asbestos textile firms discussed Hueper's 1955 publication with great concern, acknowledging among themselves that cancer was a major health problem of the industry. However, they rejected a proposal for a cancer study, fearing that such research might "stir up a hornet's nest" of bad publicity and regulation. Several years later in 1960, the Board of Directors of the National Insulation Manufacturers Association voted down the creation of a health program, 6–2. Many of the firms in NIMA either made sprayed asbestos insulation or sold asbestos fiber to firms that did.

The Johns-Manville Corporation dominated the U.S. asbestos industry, accounting for more than half of the asbestos used here in manufacturing throughout this century. Documents obtained recently through legal discovery reveal that an ongoing conspiracy existed for many years, between Johns-Manville attorney Vandiver Brown, Raybestos-Manhattan President Sumner Simpson, and others. Brown was the architect of the conspiracy to suppress knowledge of the hazards of asbestos, involving, for example:

(1) editing of an industry-sponsored medical survey conducted by Dr. A. J. Lanza, of Metropolitan Life, published with crucial changes suggested by Brown, in 1935;

(2) supporting animal studies at the Saranac Laboratory for Research on Tuberculosis (in New York), whose purpose Sumner Simpson described as follows to four other industry executives:

"My own idea is that it would be a good thing to distribute the information among the medical fraternity, providing it is of the right type and would not injure our companies." (Nov. 10, 1936)

Subsequently, Johns-Manville's Brown vetoed publication of research done at Saranac which showed the damage asbestos caused in cats.

In 1936, the Public Health Service informed asbestos textile firms in North Carolina that it planned a medical and engineering survey. The companies responded by firing 150 out of less than 600 employees in those plants, most of whom were asbestotics, prior to the Public Health Service's arrival. This gutted the data base the government needed, especially regarding the dangers associated with less-intense, long-term occupational exposure to asbestos Dust.

In 1947, the members of the Asbestos Textile Institute had confidential plant surveys conducted by the Industrial Hygiene Foundation. They were told that much more effort was needed to determine the effects of long-term exposure to levels less than the Public Health Service's tentative threshold limit value of 5 million particles per cubic foot of air.

The hazards of applying sprayed asbestos insulation must have been obvious to industry from the day these products were introduced. Industry sources give values of 150 to 1500 fibers per milliliter of air for undamped spraying of asbestos (the current U.S. standard forbids peak exposures over 10f/ml). Equally high dust levels arise from sweeping up the debris. Spraying asbestos was so hazardous that in 1945 the Chief Inspector of Factories in Great Britain sent a notice to 70 thermal insulation contractors advising among other things that "no other person should work in the same compartment (of a ship where asbestos spraying was done) unless also provided with a respirator."

It is possible that one or two smaller firms failed to realize how dangerous asbestos was, and this in turn led them to use it in sprayed formulations rather than employ safe substitutes. Johns-Manville did not even begin to affix euphemistic caution labels on its sacks of asbestos fiber until late in 1968 or 1969. Other asbestos mining companies didn't put warning labels on their product until the 1970's. By that time, minutes of the Asbestos Textile Institute were full of talk about (1) supporting research at McGill University in order to obtain favorable publicity (1965); and (2) bringing pressure on Dr. Irving Selikoff at the Mount Sinai School of Medicine to not make so much noise about the cancer threat of asbestos (1971). The minutes of the trade association meetings are devoid of anything except concern for the health of the asbestos business.

The Canadian asbestos mining firms finally supported an epidemiological study by the Industrial Hygiene Foundation (published 1958), that was aptly described by Wilhelm Hueper as, "statistical acrobatics which tend to obscure incriminating evidence" about carcinogenicity.

In view of all this, it is not so surprising that sprayed asbestos insulation products came into widespread use in this country starting only 20 years ago. The long-time suppression of information on the hazards of asbestos, especially carcinogenicity, and industry's failure to support scientific medical research was an essential step in paving the way for such a product to achieve widespread acceptance in the 1960's.

No less foreseeable than the epidemic of cancer initiated among millions of construction workers was the deterioration of asbestos ceilings in school buildings. Vandalism, horseplay, and such things as indoor ball playing all take their toll on school structures, in addition to the common problems of aging (moisture, vibration, etc.) over the years. Equally foreseeable to those who were "keeping the lid on asbestos" was the enormous renovation and demolition hazard we would have to reckon with as these buildings become old and obsolete at the end of this century.

And though the abuses of the asbestos industry probably did a great deal to stimulate the public awakening to the issue of environmental cancer in the 1970's, most of this story took place before there was much of an occupational or environmental regulatory authority in the country to oppose the freewheeling marketing plans of the asbestos industry.

CONCLUSION

Congressman Miller's bill thus has the merit of (1) placing a financial responsibility on the shoulders of those who profited by the marketing of these deadly products; and (2) setting some limit on the readiness with which public funds alone will be used to deactivate the cancerous minefield our schools have become as a result of criminal business practices.

8 - 1

UNIVERSITY OF LOUISVILLE
HEALTH SCIENCES CENTER
LOUISVILLE, KENTUCKY 40232

SCHOOL OF MEDICINE
DEPARTMENT OF PHYSIOLOGY AND BIOPHYSICS

March 23, 1979

Representative Carl Perkins
402 Canon
House Office Building
Washington, D.C. 20515

Dear Chairman Perkins:

The problem of asbestos analysis in our environment has become an environmental problem of great magnitude due to the high incidence of malignancy caused by inhalation and/or ingestion of airborne or water borne fibers.

The asbestos fiber has several forms and as its fiber length decreases the smaller crystals tend to form highly charged areas at their ends. These positive charges attract them to lung or intestinal cell membranes where they are taken up readily. The nature of these very small fibers with a high charge density induces malignant changes which can then metastasize to other organs causing inoperable cancerous focal points throughout the body.

The size of the most dangerous airborne fibers (chrysotile asbestos) may be 0.02 to 0.04 um in diameter. The range of dangerous fiber size found in lung tissue is thinner than 3 um and shorter than 200 um. Electron microscopy is therefore necessary not only to see these fibers but to conduct specific analysis on their elemental composition.

The problem of deciding which analytical technique to use in asbestos analysis varies from optical methodology to more recent developments in our technology, such as use of a scanning electron microscope with an attached x-ray energy dispersive mini-computer system.

Review of systems Analysis:

Scanning Microscope with Energy Dispersive X-Ray Analysis System (EDXA)

Cost of this system is initially high but large samples can be scanned and with the use of "backscatter" electrons small fibers can be viewed for morphology down to 50-70 Å resolution.

Zoom magnification can be used to visualize low and high power pictures simultaneously while a qualitative energy readout can identify the "finger prints" of the fibers inter structure and its basic elemental composition. The newer technology allows untreated samples to be looked at and analyzed directly. Therefore speeding up the analytical method. This is about 90% positive in determining asbestos and its type.

Transmission Electron Microscopy (TEM) + Selected Area X-Ray Diffraction

This method also is expensive to install but gives the highest resolution in smaller fiber morphology (1-2 Å). The small fibers can also be characterized by selecting one field and using the microscope's electron beam to produce a "finger print" pattern of dots on circles which can be compared to reference patterns for identification. This technique is also very reliable but error can result from poor angles on the crystals examined and some overlap from non-asbestos materials giving very similar patterns. The sample preparation is very time consuming, therefore the method tends to be used more for very small amounts of the tiniest fibers in H_2O or air and requires 10-25 hours of specimen preparation. Reliability is also high with this method.

X-Ray Diffraction

This technique can be used with no pictorial image or morphology and relatively large samples can be surveyed. Cost is moderate but the 5 types of asbestos can produce confusing patterns. The expertise required is great and the reliability depends on much training and interpretive ability. False positives can be produced by this method.

Optical Microscope - Polarized Light

Crystals such as asbestos bend light waves and produce color patterns under a light microscope equipped with polarized light. A small sample on a microscope slide is suspended in a medium or oil which has a refractive index that may enhance or extinguish the light coming through the asbestos fibers. Small samples can be readily prepared in a series of suspending liquids and examined for color characteristics of large fibers. Rapid screening of bulk material is possible but only of the larger fibers. Most of the dangerous fibers are below the resolution of the optical microscope and one might miss the presence of many smaller carcinogenic fibers while assuming there is no asbestos present. Thus, a false negative finding could be reported. This method in any event would require a "back-up" analysis to spot check the results. Scanning electron microscopy with x-ray energy dispersive analysis would probably be the most efficient double-check on this method. The cost of optical analysis is low.

In summary, this investigator feels that the most promising method for rapid, accurate and reliable analysis of asbestos in air, H_2O, or bulk would be a combination of scanning electron microscopy with energy dispersive x-ray analysis capabilities. Both graphic and elemental analysis is thus possible and the incidence of reliability is high. Large number of samples should cost less than just a few samples, and if a systematic analytic endeavor were instituted the cost per sample should be within the range of all areas needing such surveys.

Sincerely yours,

Burton B. Silver, Ph.D.
Assistant Professor

BBS:khh

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SCHOOL OF MEDICINE
DEPARTMENT OF PHYSIOLOGY AND BIOPHYSICS

March 16, 1979

Bradford J. Block, M.D.
127 Building
Kentucky Department of Labor
Frankfort, Kentucky 40601

Dear Dr. Block:

As indicated in our recent telephone conversation, I wish to inform you that my electron microscope laboratory at the University of Louisville School of Medicine is currently engaged in asbestos research and survey analysis.

We are examining drinking water samples for asbestos from the National Park Service from about 15 sites in the Southwest. This survey involves detection of very small amounts of abbestos fibers with the electron microscope and their discrete analysis utilizing x-ray diffraction modes of our instrumentation. Since different types of asbestos and/or other fibers have characteristics patterns, we can determine the type of asbestos or non-asbestos material.

Biological work is also under way to further understand the mechanisms by which the very small fibers induce malignancy (such as lung mesotheliomas).

Kentucky public buildings may have asbestos fiber counts which are hazardous to occupants and this possible hazard may also be related to the species of asbestos present since certain types of fibers (chrysotile) are extremely carcinogenic. These findings are supported by research done on asbestos for the past few years.

The ideal way to characterize and survey such probable situations would be to employ a newer type of instrumentation, which I will have available in a few months.

The Analytical Scanning Electron Microscope (STEM) has now reached the "state of the art development" in visualizing fine structures of biological, medical, and environmental pollutants and also utilizes a highly sophisticated mini computer technology which allows quick and precise analysis of suspected materials by a technique known as "energy dispersive x-ray analysis". It is my intention to provide this area with the services of such an instrument with which many departments and units can interface in the very near future.

I would be very interested in offering my services to the problems of asbestos analysis and detection in particular, and to the problems of environmental pollution in general. In April, I have planned to finally select the best instrument of this type and locate it in the Louisville area for those organizations or individuals who need this type of data not currently available.

The cost of a Scanning Analytical Electron Microscope is very high, the x-ray-computer detector alone will probably cost over $25,000. However, I see this as an investment in the health and quality of life in Kentucky and am willing to expend my research expertise to continue to improve the general health care and investigations of health problems in my Kentucky residence of 14 years.

It would be of great help in establishing our new laboratory facility if we could have some "feedback" on the probability of pursuing these environmental problems by utilizing our expertise and experience, which I would be most happy to provide.

Sincerely,

Burton B Silver

Burton B. Silver, Ph.D.
Assistant Professor

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